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WILHELM DUNKER, HIS COLLECTION, AND PTERIID SYSTEMATICS

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ABSTRACT

Wilhelm Dunker was the foremost expert on the systematics of the bivalve family Pteriidae (referred to as genus *Avicula* in his time) in the nineteenth century. His work on the group culminated in the monograph *Die Gattung Avicula*, a part of the significant conchological iconography, *Systematisches Conchylien-Cabinet* (Küster et al., 1837–1920). Dunker's volume remains unsurpassed in the taxonomic scope and the quality of illustrations. However, despite the fact that *Die Gattung Avicula* was readily available and widely cited, few specialists consulted the actual type material from the Dunker collection, which fell into oblivion for over a century. In this work, we attempted to reconstruct the contents and the history of Dunker's collection of pteriid bivalves, the specimens of which derive from two principal repositories, the Museum für Naturkunde in Berlin and the Aquazoo-Löbbecke Museum in Düsseldorf. In addition to the annotated catalog of type and figured specimens, many of which are here recognized for the first time, this contribution gives an account of Dunker's life and science, and provides an overview of pertinent contemporary shell collections.

Key words: Mollusca, Pterioidea, pearl oysters, historical collections, taxonomy, systematics.

INTRODUCTION

The superfamily Pterioidea Gray, 1847: 199, is an ancient lineage of epifaunal marine bivalves distributed throughout the tropical and subtropical continental shelf regions. In the modern seas, pterioidean bivalves are integral components of a wide range of marine ecosystems, including threatened mangroves and coral reefs. Commercial cultivation of marine pearls rests largely on pearl oysters of a pterioidean genus *Pinctada* Röding, 1798.

Living Pterioidea includes four families: Pteriidae Gray, 1847; Isognomonidae Woodring, 1925: 57; Malleidae Lamarck, 1818: 424; and Pulvinitidae Stephenson, 1941: 151 (Newell, 1969; Boss, 1982; Butler, 1998; Tëmkin, 2006a). With the exception of Pulvinitidae, which has recently been revised (Palmer, 1984; Tëmkin, 2006b), the status of the other families requires taxonomic scrutiny. The revision is necessitated by recent phylogenetic studies that challenged an assumed monophyly of these groups (Steiner & Hammer, 2000; Giribet & Distel, 2003; Tëmkin, 2006a). Particularly daunting is species-level revision of pterioidean taxa due to a high degree of plasticity in shell shape and color, the two principal characters upon which the traditional classification of the group was based. Whereas the state of taxonomic chaos in pterioidean systematics is widely acknowledged, no attempts for improvement have been made in recent years.

The rampant proliferation of pterioid species names was largely due to the increase in number of named species of the family Pteriidae in the early to mid-nineteenth century, when the family was typically circumscribed by the generic name *Avicula.* Introduced by Bruguière in reference to the Recent Pterioidea (Bruguière, 1792: pl. 177), *Avicula* was variably used in either a more restrictive sense corresponding to the contemporary pteriid genus *Pteria* Scopoli, 1777: 397, or as a broader category, comparable to the presently recognized family Pteriidae. Pteriid species are notorious for possessing few discrete, easily identifiable shell characters. Minor differences in color (often greatly differing among members of the same population and even through the ontogeny of a single individual), shape (particularly in the degree of obliquity and the extent of the posterior auricle), size (such as seen between juvenile and adult forms), as well as geographical origin,

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were routinely used as criteria for establishing new species names.

A few nineteenth-century authors, however, were chiefly responsible for erecting large numbers of species names of *Avicula*, typically accompanied by rather meager descriptions, albeit often provided with accurate illustrations. Three works are of principal importance: a section on *Malleacea* in Lamarck's *Histoire naturelle des animaux sans vertèbres* (Lamarck, 1819: 135–152), and monographs on the genus *Avicula* by Reeve (1857) and Dunker (1872–1880). In Lamarck's system, the genus *Avicula* encompassed contemporary pteriid genera *Pteria* and *Electroma* Stoliczka, 1871: 391, and his *Meleagrina* Lamarck, 1819: 150, was equivalent to the currently recognized genus *Pinctada* (which is now considered a senior synonym of *Meleagrina*). Reeve placed all these taxa under the name *Avicula*, whereas Dunker distinguished *Meleagrina* as a subgenus of *Avicula*.

Unlike the work of Lamarck, which contained only brief descriptions, and that of Reeve, the value of which almost exclusively rests on the illustrations, the synthesis by Dunker was far more comprehensive. It contained an extensive introduction, detailed species descriptions with discussions, synonymies, additional important commentaries at the end of the volume, and superb illustrations, sometimes more than one per species. Partly based on his prior publications on the group (Dunker, 1848, 1852), Dunker's monograph *Die Gattung Avicula* (Dunker, 1872–1880) was published as a part of one of the largest and most significant conchological iconographies, *Systematisches Conchylien-Cabinet von Martini und Chemnitz* (Küster et al., 1837–1920). In this work, he revised over one hundred species of Pteriidae and described 30 new species (of total 47 pteriid species named by Dunker). The establishment of such large number of species, "rather too many for a genus, the species of which are so variable," was criticized by Martens (1874: 172) shortly after its publication.

Surprisingly, despite the importance of Dunker's contribution and a widespread use of names established by him, few, if any, later bivalve workers consulted the actual type material from the Dunker collection. Subsequent partial or regional revisions (Jameson, 1901; Hynd, 1955; Ranson, 1961; Wang, 1978; Shirai, 1994; Hwang & Okutani, 2003) referred to the material from the Cuming collection (presently at The Natural History Museum, London) upon which Reeve's (1857) monograph was based, but did not consider Dunker's specimens, most of which are still extant at the Malacozoological Collection of the Museum für Naturkunde. A number of specimens from the Scheepmaker and the Gruner collections (presently at the Aquazoo-Löbbecke Museum, Düsseldorf) that Dunker used as a basis for establishing new species also escaped the attention of subsequent workers. It is ironic that one of Dunker's names, *Pinctada martensii* (Dunker, 1880), is frequently applied to one of the most important commercial pearl oyster species in the Indo-Pacific region, whereas Dunker's type specimens have neither been discussed nor illustrated since its original publication. Consulting the original type specimen proved instrumental for unequivocal establishing the species identity of *Pinctada longisquamosa* (Dunker, 1852) and allowed for a more accurate assessment of its geographic range in a recent revision of the species (Mikkelsen et al., 2004).

The objectives of this work are (1) to highlight the significance of Wilhelm Dunker's contribution to malacology and, more specifically, to pterioidean systematics, and (2) to compile an annotated catalog of types and figured specimens of *Avicula* from his collection. This work is a significant contribution toward the on-going taxonomic revision of pterioidean taxa (Mikkelsen et al., 2004; Tëmkin, 2006a, b), as well as a part of a systematic effort to catalog type material housed at ZMB (e.g. Köhler, 2007; Dijkstra & Köhler, 2008).

BIOGRAPHY OF DUNKER

Wilhelm Bernhard Rudolph Hadrian Dunker (b. 1809 – d. 1885; Fig. 1), a professor of geology and mineralogy, and a state official in charge of mining in Marburg, Germany, amassed an extensive shell collection that eventually became an invaluable part of the mollusk holdings at the Museum für Naturkunde in Berlin. Despite the fact that Dunker was among leading malacologists of his day, little attention has been paid to both his character and the significance of his collection. The latter is particularly surprising given the large number of type specimens it contains and, hence, its relevance to the current taxonomic practice. This section provides a biographical sketch of Dunker based on prior published biographical notes and obituaries (Anonymous, 1885; Kobelt, 1885; Koenen, 1885; Crosse & Fischer, 1886; Andrée, 1955; Schmidt, 1973), and on previously unpublished documents.

Dunker was born on February 21, 1809, in Eschwege in the eastern part of Hesse, west-central Germany. He attended a gymnasium (an equivalent of a college preparatory secondary school) first in Kassel and later in Rintelen, where his father had served as an army officer since 1815. Dunker proved to be a talented artist, and at the age of 14 he was awarded a silver medal of the Kassel Art Academy for his drawings of natural history objects. As a student, he began to collect shells, insects, and minerals. Upon passing his exams, Dunker began studying mining while working in copper mines near Riechelsdorf and coal mines near Obernkirchen. His interests expanded to include geology, mineralogy, and paleontology. In 1830 Dunker entered the University of Göttingen, where he attended lectures by the anatomist Johann Friedrich Blumenbach (b. 1752 – d. 1840), and the mathematician and astronomer Carl Friedrich Gauss (b. 1777 – d. 1855), among others. While continuing working on mining around Karlshütte und Obernkirchen, Dunker received his doctoral degree from the university in Jena in the summer of 1838.

In 1839, at the age of 30, Dunker was assigned as a lecturer of mineralogy and geology at the polytechnic school in Kassel, Hesse. The following year, he married his cousin Elise Sommer. Although they did not have children, their 45-year long marriage was apparently happy. The appointment in Kassel not only provided Dunker with access to important libraries but also brought him in contact with two renowned German malacologists of the time, Rudolph Amandus Philippi (b. 1808 – d. 1904) and Ludwig Carl [Karl] Georg Louis Pfeiffer (b. 1805 – d. 1877), who rekindled Dunker's interest in mollusks.

In the period of 1846–1878 Dunker became one of the editors (together with the vertebrate paleontologist Hermann von Meyer) of the journal *Palaeontographica, Beiträge zur Naturgeschichte der Vorwelt*. After Meyer's death in 1869, Dunker alone edited 18 volumes of the journal, several supplement volumes,

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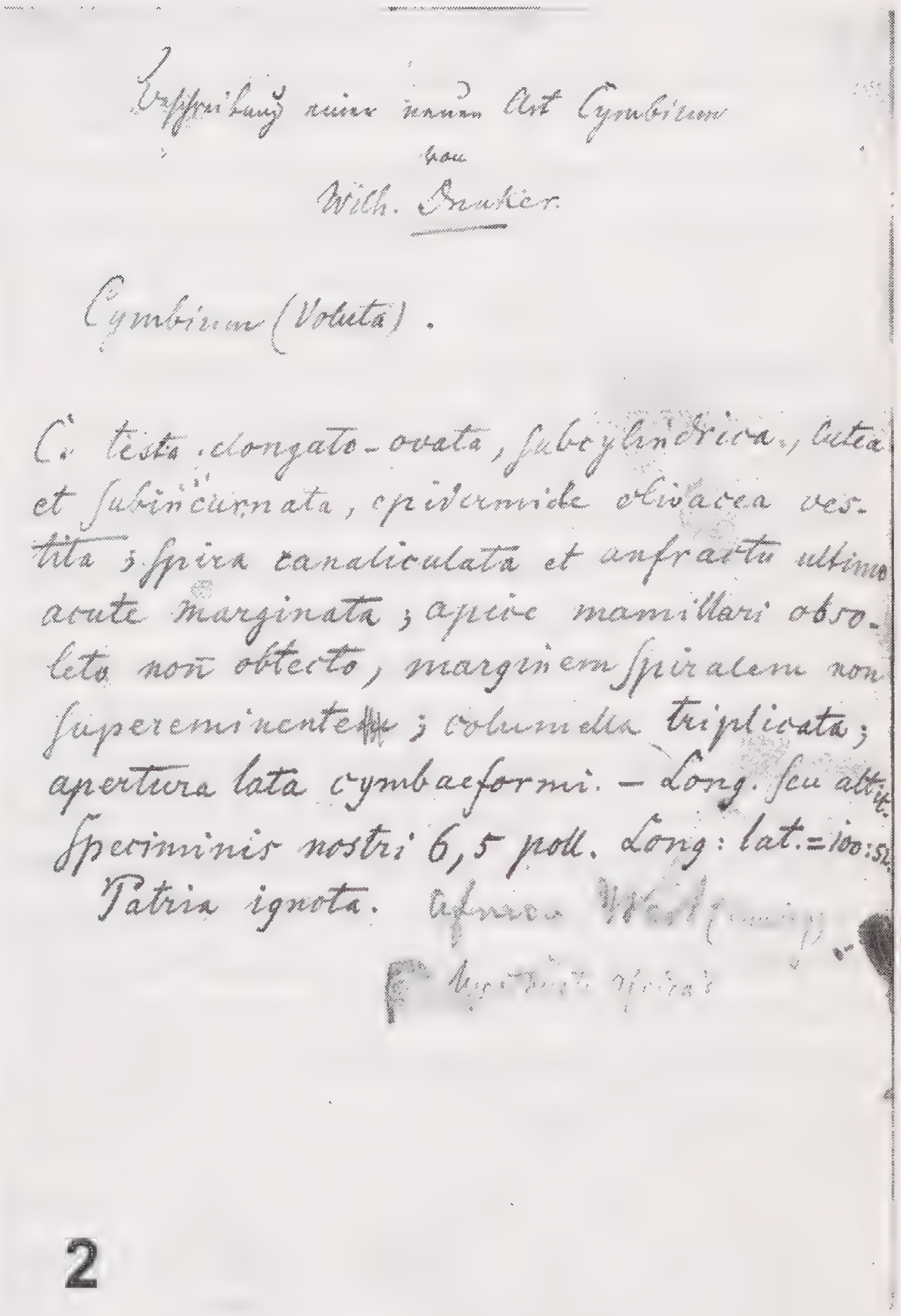
Beſchreibung einer neuen Art Cymbium
von
Wilh. Dunker.

Cymbium (Voluta).

C. testa elongato-ovata, ſubcylindrica, lutea et ſubincarnata, epidermide olivacea vestita; ſpira canaliculata et anfractu ultimo acute marginata; apice mamillari obsoleto non obtecto, marginem ſpiralem non ſupereminentem; columella triplicata; apertura lata cymbaeformi. – Long. ſeu alt. ſpeciminis nostri 6,5 poll. Long: lat.=100:5
Patria ignota. Africa [illegible]
[illegible]

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FIGS. 1, 2. Wilhelm Rudolph Bernard Hadrian Dunker (1809–1885). FIG. 1: Portrait of Dunker. Museum für Naturkunde der Humboldt-Universität zu Berlin Historische Bild- u. Schriftgutsammlungen Signatur: B I/30; FIG. 2: A sample of Dunker's handwriting. Handschriftenarchiv der malakologischen Sammlung, Museum für Naturkunde.

and co-edited six volumes with Karl Alfred von Zittel (b. 1839 – d. 1904). He maintained correspondence with prominent geologists and paleontologists, including Christian Leopold Freiherr von Buch (b. 1774 – d. 1853) in Berlin (Glaubrecht, 2004) and Gideon Algernon Mantell (b. 1790 – d. 1852) in London.

In 1854 Dunker moved from Kassel to Marburg, where he served as a professor and a director of the mineralogical-geological institute at the Philipps University. The institute, however, did not have an extensive collection, and Dunker used his private collection in his lectures that were often held at his residence. By that time, Dunker's shell collection grew large, partly through purchases, but largely due to gifts by friends, colleagues, and former students. Dunker's reputation as a distinguished conchologist grew along with his collection and soon material from all over the world was sent to him. Dunker rarely left Marburg after 1860 due to an aggravating chronic lung illness. In 1867–1868 he was commissioned to re-curate the shell collection in Naturhistorischen Museum in Hamburg, which he did according to the system of the Adams brothers (H. Adams & A. Adams, 1853–1858) (Weidner, 1993: 111, 133).

Dunker exchanged specimens with other conchologists, most notably Hugh Cuming (b. 1791 – d. 1865) of London, who was one of the most important collectors and dealers of the nineteenth century (Dance, 1980, 1986). Karl Eduard von Martens (b. 1832 – d. 1904), the director and curator in charge of the invertebrate collections at the Berlin für Naturkunde in Berlin, explicitly commented on the Dunker-Cuming correspondence in an unpublished report on the Dunker shell collection (Martens, 1885). According to Martens, Cuming considered Dunker's collection to be the best in Germany and repeatedly visited Dunker in Kassel and in Marburg, possibly upon his return from the Philippines in 1840 or, more likely, in the 1850s, when Dunker's reputation expanded beyond German borders. Although speculative at present, Cuming might have been become acquainted with Dunker through Pfeiffer, whom Cuming met during his trip to Europe in 1832–1835 (Dance, 1980: 484). Surprisingly, Dance mentions Dunker neither in his biography of Cuming (Dance, 1980), nor in his extensive treatment of the history of conchology (Dance, 1966). The second revised edition of the latter work merely lists Dunker's name in the list of Cuming's correspondents (Dance, 1986: 123).

Wilhelm Dunker passed away on March 13, 1885, in Marburg at the age of 77. He published more than 70 scientific publications, 47 of which are dedicated to extant molluscs (Koenen, 1885: 336–338, provides Dunker's bibliography). Many of his papers were published in the *Zeitschrift für Malakozoologie*, the *Journal de Conchyliologie*, the *Proceedings of the Zoological Society*, and the *Philosophical Transactions of the Royal Society of London*. Among Dunker's much acclaimed malacological works are the *Index molluscorum Guinaea* (Dunker, 1853), the *Index molluscorum maris Japonici* (Dunker, 1882), and several taxonomic monographs (Küster, Dunker & Clessin, 1841–1886; Dunker, 1872–1880, 1880–1883) published in the second edition of the *Systematisches Conchylien-Cabinet von Martini und Chemnitz* (Küster et al., 1837–1920).

Among chief contributions by Dunker is publication of the first book devoted exclusively to mollusks of Japan (Dunker, 1861), which followed his earlier paper on the subject (Dunker, 1859). The shells upon which Dunker's lavishly illustrated monograph was based, were collected by the physician Nuhn in the Nagasaki region during his stay in Dejima as a member of a German ship's crew. Nuhn presented his collection to Heinrich Georg Bronn, a professor of zoology at Heidelberg University. Bronn, in turn, loaned this material to Dunker (Cosel, 1998). These works catalyzed subsequent extensive work on the Japanese malacofauna by Carl Emil Lischke (b. 1813 – d. 1886), consisting of three volumes (Lischke, 1869–1874), the first of which was dedicated to Dunker (Cosel, 1998). Much of the Bronn collection, including types of Dunker and Lischke, are housed at Naturmuseum Senckenberg, Frankfurt/Main (Janssen, 1993; Cosel, 1998). Dunker subsequently synthesized the works of others and his earlier works on Japanese mollusks in the *Index molluscorum maris Japonici* (Dunker, 1882).

SOURCES OF SPECIMENS

In preparing the monograph on *Avicula*, Dunker had extensively consulted several collections other than his own. Consequently, some of Dunker's type specimens were – and presumably still are – contained in these collections.

Museum acronyms. BMNH – The Natural History Museum, London; formerly the British Museum (Natural History); GSUB – Geowissenschaftliche Sammlung, Universität Bremen; LMD – Aquazoo-Löbbecke Museum, Düsseldorf; MCZ – Museum of Comparative Zoology, Harvard University; MNHNCU – Museo Nacional de Historia Natural, Havana, Cuba; MNHS – Museo Nacional de Historia Natural, Santiago de Chile; SMF – Naturmuseum und Forschungsinstitut Senckenberg, Frankfurt/Main; ZMA – Zoologisch Museum, University of Amsterdam; ZMB – Museum für Naturkunde, Humboldt University, Berlin; formerly Zoologisches Museum Berlin).

Other abbreviations used in the text: juv, juvenile; LV, left valve; RV, right valve; var, variety.

The Dunker collection. Dunker's shell collection is housed at the Musem für Naturkunde (ZMB) in Berlin. After Dunker died in 1885, his collection of minerals and fossils remained at the University of Marburg in Hesse. Shortly after her husband's death, Dunker's widow offered the shell collection to the Prussian government for the sum of 18,000 marks. Karl Eduard von Martens, the director and curator at ZMB, was appointed to provide a report on Dunker's shell collection. In a letter dated by December 13, 1885 (archived at the *Geheimes Staatsarchiv Preussischer Kulturbesitz, Berlin-Dahlem*), addressed to Dr. von Goßler, the Prussian minister of education and science, Martens gave a detailed account of the collection. He stated that it contained over 119,000 specimens and approximately 26,000 species. It is noteworthy that the much-acclaimed Cuming collection, when purchased by the British Museum of Natural History in 1866, contained 83,000 specimens (Dance, 1980: 495). Martens had also remarked that Dunker left no catalogue of his collection but his former assistant, Dr. Brockmeyer, had compiled a partial inventory that included cephalopods, marine gastropods, and sections of marine bivalves, totalling 33,647 specimens corresponding to 4,746 species. Martens estimated that the remaining part, consisting mainly of land and freshwater mollusks, and the rest of marine bivalves, comprised approximately 85,470 specimens corresponding to 21,586 species. The next year, following Martens' recommendation, Dunker's shell collection was purchased by ZMB.

The Dunker collection was an enormous addition to the ZMB holdings of mollusks. Its scientific value was far beyond just a sheer number of specimens: the collection contained important type material, rare species, well-preserved specimens, lots containing growth series, and comprehensive geographical samples. Moreover, most specimens had good records of locality and collector data. There is no evidence that any shells from this collection were sold or transferred to any other repository after Dunker's death. The shells are typically well preserved and most lots contain original labels written by Dunker (frequently on green paper slips). Dunker's handwriting was authenticated with the help of the manuscripts and correspondence archived at ZMB (Fig. 2). Prior to the present investigation, some type specimens were isolated by Martens, whose hand-written labels contained species names (frequently omitting generic names; Fig. 6) and typically bear his symbol, a cross with a dot in each of the four quadrants, which marks type material (Fig. 6). Typically, Dunker's specimen lots, whether type or not, include printed labels ("coll. Dunker"; Fig. 7) that suggest that these shells were once a part of the Dunker collection.

Museum für Naturkunde, Berlin (ZMB). On a few occasions Dunker mentioned specimens from "Musaeo Berol." (or "Berolinensi"), which shows that he had access to the ZMB malacological collection. This museum was only one of initially three natural history collections of the Berlin University that were housed in the main university building at the time. Its origin predates the foundation of the university in 1810. The rapid growth of the collections soon required a larger space. Eventually, in 1889 the newly established Museum für Naturkunde consolidated individual natural history collections. It has since been among the most important institutions of its kind worldwide. The malacological collection was curated by influential scientists of their times, such as Franz Hermann Troschel (b. 1810 – d. 1882), Karl Eduard von Martens, Johannes Thiele (b. 1860 – d. 1935), and Bernhard Rensch (b. 1900 – d. 1990). When Dunker's collection was incorporated into the museum in 1886, it constituted approximately half of the mollusk holdings. Today, ZMB houses over nine million specimens of mollusks that represent approximately 55,000 described species. Types are estimated to represent roughly 10,000 species. Much of the material originated from private collections, as well as from large scientific expeditions, such as the German Deep Sea Expedition (1898–1899), the German South Pole Expedition (1901–1903), and the Sunda Expedition (1927).

The Scheepmaker collection. Gerrit Scheepmaker (b. 1811 – d. 1854), a school teacher and amateur collector from Amsterdam, made a large donation of shells to the Royal Zoological Society *Natura Artis Magistra* ("Artis"), the precursor of the Zoologisch Museum of the University of Amsterdam (ZMA), in 1844. Many of the specimens were bought in 1855 by Jacob Voorhoeve (b. 1811 – d. 1881), whose collection was offered for sale at an auction in 1872 (Benthem Jutting, 1939: 212; Engel, 1939: 312; Dance, 1986: 154). Some specimens purchased at the sale went directly to Artis and some others came there in later years. In the 1860s, Carl Heinrich Wilhelm Theodor Löbbecke (b. 1821 – d. 1901) purchased the most valuable part of Scheepmaker's collection, which together with other collections acquired by Löbbecke (most notably those of Lischke, van Lennep, and Gruner) became a part of his private conchological museum *Museum Loebbeckeanum* in his house in Düsseldorf. In October 1901, after Löbbecke's death, his widow donated the collection and library to the town of Düsseldorf. The collection was eventually transferred to the newly established municipal *Löbbecke-Museum, Naturkundliche Sammlung der Stadt Düsseldorf*, which opened in 1904. The Löbbecke-Museum was the foundation of today's Aquazoo-Löbbecke Museum (LMD) (Kobelt, 1904; Dance, 1986: 157, 217, 225; Cosel, 1998; Boscheinen, 2004). Thus, presently many Scheepmaker's specimens are either at ZMA or LMD. Even though there is no direct evidence of Dunker's visiting the Scheepmaker collection, the fact that Dunker received specimens from Scheepmaker (Dunker, 1872: 5) indicates that he had examined them prior to the publication of his monograph.

The Gruner collection. Erich Christian Ludwig Gruner (b. 1786 – d. 1857) was a major in the Danish service stationed on St. Thomas Island in the West Indies (now part of the United States Virgin Islands) (Weinder, 1993: 87, 88). Upon retirement, Gruner moved to Bremen in 1827, where his brother, August Wilhelm, owned a West Indies trading company. In 1835 Gruner became a consul and a trading agent for the Grand Duchy of Mecklenburg-Schwerin. His large collection, known as the "Museum Gruneri," was available for study by specialists, including Dunker and Israel Heymann Jonas (b. 1795 – d. 1851). Upon Gruner's death in 1857, a 49-page sale catalog (*Verzeichniß der Conchyliensammlung des verstorbenen Herrn Consul Gruner, welche im Ganzen verkauft werden soll von Bunsen Hausschild 1857.* Bremer Druck 1857) was published, and the collection was advertised for sale in the same year. The collection was intended to be sold as a whole (Tomlin, 1942: 30; Dance, 1986: 157), but it was eventually disseminated in parts. Most specimens were purchased by Hermann von Maltzan (b. 1843 – d. 1891) and later sold to Löbbecke, whose collection is presently housed at LMD (Zilch, 1967). Gruner also exchanged material with colleagues and institutions, and some of his specimens are also extant in other museums, including ZMB and SMF. One of Dunker's type specimens (*Avicula straminea* Dunker, 1852; ZMB 112.865), which originated from the Gruner collection, had a label of the Paetel collection. This suggests that some of Gruner's shells might have been acquired by Friedrich Paetel (b. 1812 – d. 1888). Other specimens might still be extant at the Geowissenschaftliche Sammlung, Universität Bremen (GSUB). Trew (1990: 74) mistakenly attributed the sale of Gruner's collection in 1857 to a different (possibly unrelated) Gruner, a lieutenant general from Denmark, whose cabinet with nearly complete collection of Danish and Norwegian shells, was referred to by Regenfuss (1758) (Dance, 1986: 186).

The Rodatz collection. Little is known about Rodatz and his collection, an important source of material used by Dunker. Hans Albert Rodatz (sometimes referred to as "Rodaz") of Bremen was a ship captain and worked for the Wm. O'Swald & Co. trading company in Hamburg (Weidner, 1993: 87, 88, 91; Schneppen, 2006: 21, 25). He participated in a number of commercial expeditions from Germany to Zanzibar and Western Africa in the period of 1843–1851. Presumably, Rodatz obtained some of the shells during these voyages. He collected many mollusks from the Red Sea in 1845 and offered his specimens to Naturhistorischen Museum in Hamburg, where this material was described by Jonas (1846) (Weidner, 1993: 87, 88). Some of Rodatz's materials collected in Zanzibar were owned by Pfeiffer (Mead, 1995: 259).

The Cuming collection. The collection of Hugh Cuming (b. 1791 – d. 1865) is considered to be one of the largest and taxonomically most significant shell collections of the nineteenth century (Dance, 1980, 1986). Most specimens from the Cuming collection are presently at The Natural History Museum in London (BMNH; Dance, 1986: 209), including the pteriid shells that formed the basis of Reeve's revision of

Avicula (Reeve, 1857). Cuming extensively exchanged shells with and sold specimens to other collectors. For example, the SMF and ZMB collections contain shells that were either obtained from Cuming directly or as part of other collections – Neubert & Janssen (2004) and Köhler (2007) provide examples. Dunker extensively corresponded with Cuming (Martens, 1885) and had an opportunity to examine his collection personally during his stay in London (Dunker, 1872: 5). None of Dunker's pteriid names were based exclusively on the Cuming material, but Dunker illustrated many Cuming's shells. One lot containing two pairs of *Pteria* is accompanied by a label written by Dunker that states that the lot originated from the Cuming collection ("Avicula / England. / H Cuming").

The Tams collection. Little information is available about the collection of Georg Tams, a surgeon and an amateur shell collector. According to Dunker (1853: iii, iv), Tams collected rare shells in Venezuela and Guinea, and made them available for study to other malacologists, such as Pfeiffer and Karl Theodor Menke (b. 1791 – d. 1861). In his introduction to an illustrated catalog of Tam's shells from Guinea, Dunker (1853) highly praised Tams for his enthusiastic and meticulous collecting. Despite the use of academic Latin, the tone suggests that Dunker and Tams were on friendly terms. In 1845 Tams published an account of his travels to southwestern Africa as a medical doctor to the Portuguese commercial expedition (Tams, 1845). This work was translated into English in the same year. Many shells in the Dunker collections – including type and non-type specimens – originate from the Tams collection.

The Gundlach collection. Johannes Christoph Gundlach (b. 1810 – d. 1896), an ardent naturalist and collector, received a degree in liberal arts from the university in Marburg in 1837, where he earned a doctoral degree in zoology in 1838 (Weidner, 1993: 38, 39). On November 1 of the same year he sailed on a voyage to Cuba in a company of Pfeiffer, a malacologist, and C. F. Eduard Otto (b. 1812 – d. 1885), a botanist. Gundlach settled in Cuba, where he continued collecting throughout his life and supplied his European colleagues with specimens from the Caribbean (Ramsden, 1915; Papavero, 1971: 181–183; Weidner, 1993: 39). There is no evidence that Gundlach was in direct contact with Dunker, but his list of correspondents included Louis Pfeiffer, who received specimens of over 200 new molluscan species from him (Jacobson, 1972: 38) and knew Dunker personally. Dunker (1879: 41), however, referred to Gundlach as a friend, suggesting they might also have known each other. Also the fact that Dunker's collection contains lots of shells from Gundlach suggests that both men were in touch. From 1849 on Gundlach repeatedly traveled to Cuba and between 1873–1881 to Puerto Rico. In 1867 he exhibited parts of his collection at the world exhibition in Paris and visited the museum in Berlin. In 1892, he sold his collections to the Spanish government, forming the basis for the Museo Nacional de Historia Natural in Havana (MNHNCU) (Ramsden, 1915: 255; Piechocki, 1992). Specimens from the Gundlach collections are presently housed at the Instituto de Ecología y Sistemática de La Habana, Cuba (Fernández Milera et al., 2002). Most certainly, the specimens used by Dunker were from the European collections. Some of Gundlach's specimens found their way into the collections of ZMB and SMF. ZMB holds a significant number of Gundlach's lots that were obtained from him directly or through Pfeiffer or Dunker.

The Reents collection. No information was found on Reents from Hamburg [referred to as "Reents Hamburgensis" by Dunker (1872: 10)] or the history of his collection. According to archival materials, Reents donated specimens of armadillos to Naturhistorischen Museum in Hamburg in 1868 and, possibly, worked there in the collection of mammals (Weidner, 1993: 214).

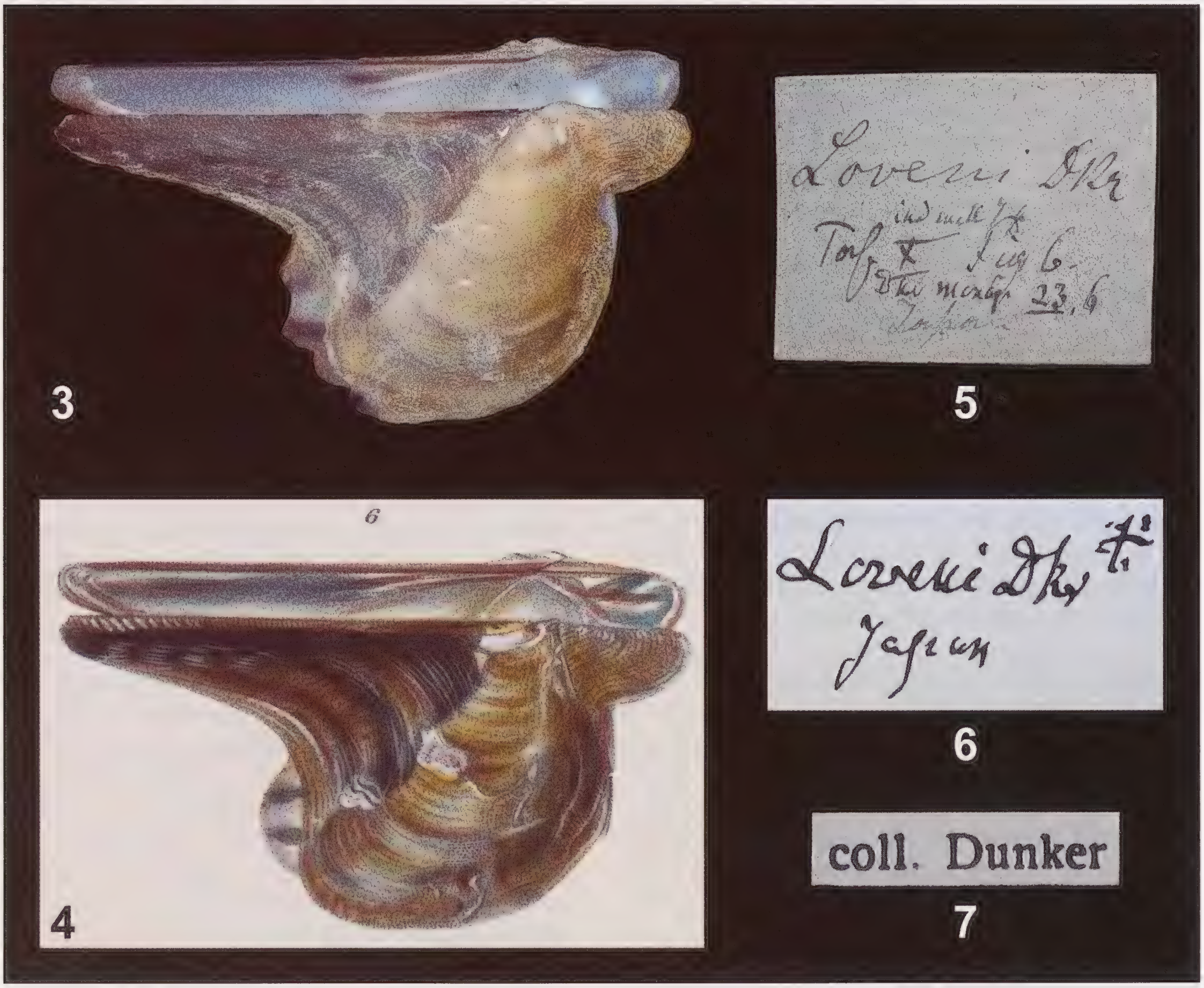
BIBLIOGRAPHICAL SOURCES

Dunker had access to all essential historical and current literature on the genus *Avicula* and produced a sound taxonomic revision, critically pointing out problems in prior taxonomic practice and difficulties in determining species boundaries. He established comprehensive synonymies and resolved many nomenclatural issues. Dunker was well versed in pre-Linnaean literature and cited such ancient writers as Rondelet (1554–1555) and Aldrovandi (1606), among others, and was aware of rather obscure publications of taxonomic significance, such as the *Museum Boltenianum* (Röding, 1798).

Although Dunker was acquainted with foreign collections, such as that of Cuming, he apparently had not seen specimens from Lamarck's collection. The evidence for this is that some of Lamarck's original specimens correspond to shells in the Cuming collections in all respects, and certainly their similarity would not escape the eye of an experienced conchologist. However, Lamarck's work had not been illustrated and his descriptions did not provide enough detail to establish species identity without ambiguity. Dunker regretfully commented on Delessert's (1841) failure to illustrate many of Lamarck's shells, the identity of which could not be established without viewing the original specimens or good illustrations (Dunker, 1880: 76, 77). Thus, in reference to Lamarckian names Dunker relied on the opinion of Deshayes but expressed his skepticism with regard to their identity. Concerning pteriid species described by A. A. Gould (1850, 1851), Dunker concluded that the identity of his species could not be verified in the absence of illustrations or original specimens (Dunker, 1880: 79). Apparently, he was not aware of Gould's atlas with revised descriptions and well-executed figures (Gould, 1852). Therefore, Dunker relied on Reeve's (1857) interpretations of Gould's species and reproduced most of Reeve's figures to illustrate the species named by Gould.

ILLUSTRATIONS

The illustrations of shells in Dunker's monograph (1872–1880) were masterfully executed in color and in all respects are comparable to, if not more exquisite, detailed, and accurate than



Loveni Dkr
ind moll Jap
Taf X Fig 6.
Dkr monogr 23, 6
Japan

Loveni Dkr
Japan

coll. Dunker

FIGS. 3–7. *Pteria loveni* Dunker, 1879, example of type material from the Dunker collection. FIG. 3: Syntype (ZMB 108.679, 26.4 mm); FIG. 4: Dunker's (1879: 67, pl. 23, fig. 6) original illustration of the syntype; FIG. 5: Dunker's original label. Lines 2 ("ind moll Jap") and 4 ("Dkr monogr 23, 6") added by Eduard von Martens at a later date; FIG. 6: Martens' label. Note Martens' typical cross-like symbol in the top right corner marking a type lot; FIG. 7: A ZMB printed label identifying the material from the Dunker collection.

those in *Conchologia Iconica* (Reeve & Sowerby, 1842–1878), one of the most extensive nineteenth century iconographies that is highly praised for its faithful figures. Dunker himself was responsible for preparing most of the illustrations but some were executed at an earlier date by J. Rehbein from Cassel (Dunker, 1872: 5). Most images represented shells from various collections examined by Dunker, whereas others were accurately copied from various sources, most notably from the important iconographies *Neues systematisches Conchylien-Cabinet* (Chemnitz, 1785) and *Conchologia Iconica* (Reeve, 1857). The footer of the plates 1–11 bears an inscription "T. de Suplicy Nbg," possibly referring to the printer; the rest of the plates are free from any such indications. Two plates entitled "*Miess-Müscheln. Mytili.*" from the *Neues systematisches Conchylien-Cabinet* (Chemnitz, 1785: pls. 80, 81) were reproduced by Dunker in their entirety (and in the same order as in the original publication) as the last two plates of *Die Gattung Avicula* (Dunker, 1880: pls. 26, 27).

Rather then being generalized abstractions, Dunker's illustrations were finely detailed and faithfully colored, reflecting the peculiarities of actual specimens, thus alleviating the difficulty in matching actual specimens to the illustrations (Figs. 3, 4). Damages or other irregularities intrinsic to shells were precisely reproduced, whereas foreign objects attached to specimens (such as encrusting barnacles or bryozoans) were omitted. In addition, the shells were depicted in their actual size allowing direct comparison between specimens and illustrations, which is useful when dimensions are not provided in the text. Most minor discrepancies between the illustrations and the specimens are due to slight mismatch in color and marginal damage (often extensive) of the shells, resulting from aging of the paper and handling of the specimens.

Most illustrations followed a convention of depicting the exterior of the right valves with the hinge line at the top and placed horizontally, so that the shells were facing to the right side. The shells were usually shown articulated, so that only a small part of the interior surface of anterodorsal margin of the left valve could be observed. Some shells were depicted disarticulated in a staggered fashion, so that the left valve, while still largely concealed by the right valve, was shifted upward, forward, or diagonally (both upward and forward), providing a clearer view of the interior of the anterior auricle, the hinge, and the color of the nacre along the anterior or dorsal margins. A few images showing shells facing left suggest that the right valve was not available. This supposition is consistent with the observation that in cases where only the left valve was depicted, there was only a single corresponding left valve was present in the Dunker collection. Several specimens were figured with the byssus, which was also found together with the actual specimens.

The choice of whether the shell was shown with articulated or separated valves was probably dictated by the need to show some aspects of shell interior in some specimens, rather than emphasizing whether the valves where actually joined or not. For example, the earlier image of *Avicula loveni* Dunker, 1879 (Fig. 4; Dunker 1879: pl. 23, fig. 6) showed a disarticulated shell with the left valve shifted upward, whereas the same shell was shown articulated in a later publication (Dunker, 1882: pl. 10, fig. 6). In our comments pertaining to the description of the figures, it is assumed the illustrated shell faces right (unless stated otherwise) and the relationship between valves is simply referred to as "depicted articulated," or "with LV shifted upward (forward, or diagonally)."

ANNOTATED CATALOG OF THE DUNKER COLLECTION

The catalog of pteriid specimens from the Dunker collection consists of two sections. The first section lists all the species of *Avicula* named by Dunker and documents the associated type material from the ZMB and LMD collections. The second section describes the figured non-type specimens from these two collections.

The shell dimensions are provided for the right (typically less convex), valve unless it is missing or severely damaged. Hinge length was measured as the longest distance between the extremities of the anterior and posterior auricles parallel to the straight hinge line. Shell height was measured perpendicular to the hinge line to the most distal point of the ventral shell margin. Shell length was taken parallel to the hinge line (exclusive of the auricles).

Nomenclatural Issues

Dunker did not use terms "holotype," "the type," or equivalent expressions in any of his species descriptions that would fix the holotype by original designation (Article 73.1.1; ICZN, 1999: 79). In a few cases, however, the nominal species-group taxa were explicitly or otherwise unambiguously based on single specimens, rendering the extant type specimens recognized as holotypes fixed by monotypy (Article 73.1.2; ICZN, 1999: 79). Most extant type series consist of single syntypes that closely correspond to the original descriptions and illustrations. Some species-group names were based expressly on multiple specimens, but in the majority of original descriptions the number of specimens in the type series could not be established with certainty. Even though it is probable that the specimens from the latter category were based on single specimens, for the lack of definitive supporting evidence they are treated here as syntypes in accordance with the Recommendation 73F ("Avoidance of assumption of holotype"; Article 73.1; ICZN 1999: 80). In all the instances where type series consisted of multiple syntypes, all the specimens were apparently conspecific and in no case lectotype designations were necessitated in accordance with the Recommendation 74G ("Not merely for curatorial purposes"; Amendment of Article 73.1.1; ICZN, 2003: 263). Occasionally, the definitive correspondence of specimens, original descriptions, and illustrations could not be established, such specimens are discussed as "probable type material." In several cases type material could not be located. In accordance with the Code of Zoological Nomenclature, the capitalization of species-group names (Article 28; ICZN 1999: 32) was removed and necessary corrections of original spellings were made (Article 32.5; ICZN 1999: 39–42), but the original spellings are included in parentheses. The taxonomic revision is beyond the scope of the present work, and no attempt is made here to provide synonymies and determine the current taxonomic status of any of the species names discussed in the present work. Consequently, references accompanying each species entry are restricted to original descriptions, illustrations, and subsequent amendments by Dunker or other authors referring to the actual specimens from his collection.

Following the Recommendation 72E ("Publication of information on labels"; ICZN 1999: 79), all the information contained on historical labels is provided, preserving original format, spelling, and crossed-out content. The handwritten labels have been transcribed (preserving original spelling and punctuation), extensive passages translated into English, and the authorship established based on comparison with archival documents of known authorship. The translations and commentaries are included in the square brackets in the label entries. The references to whether the label inscriptions were in ink or in pencil are made only for instances where these co-occurred on the same label and were attributed to different persons.

SPECIES OF *AVICULA* NAMED BY DUNKER

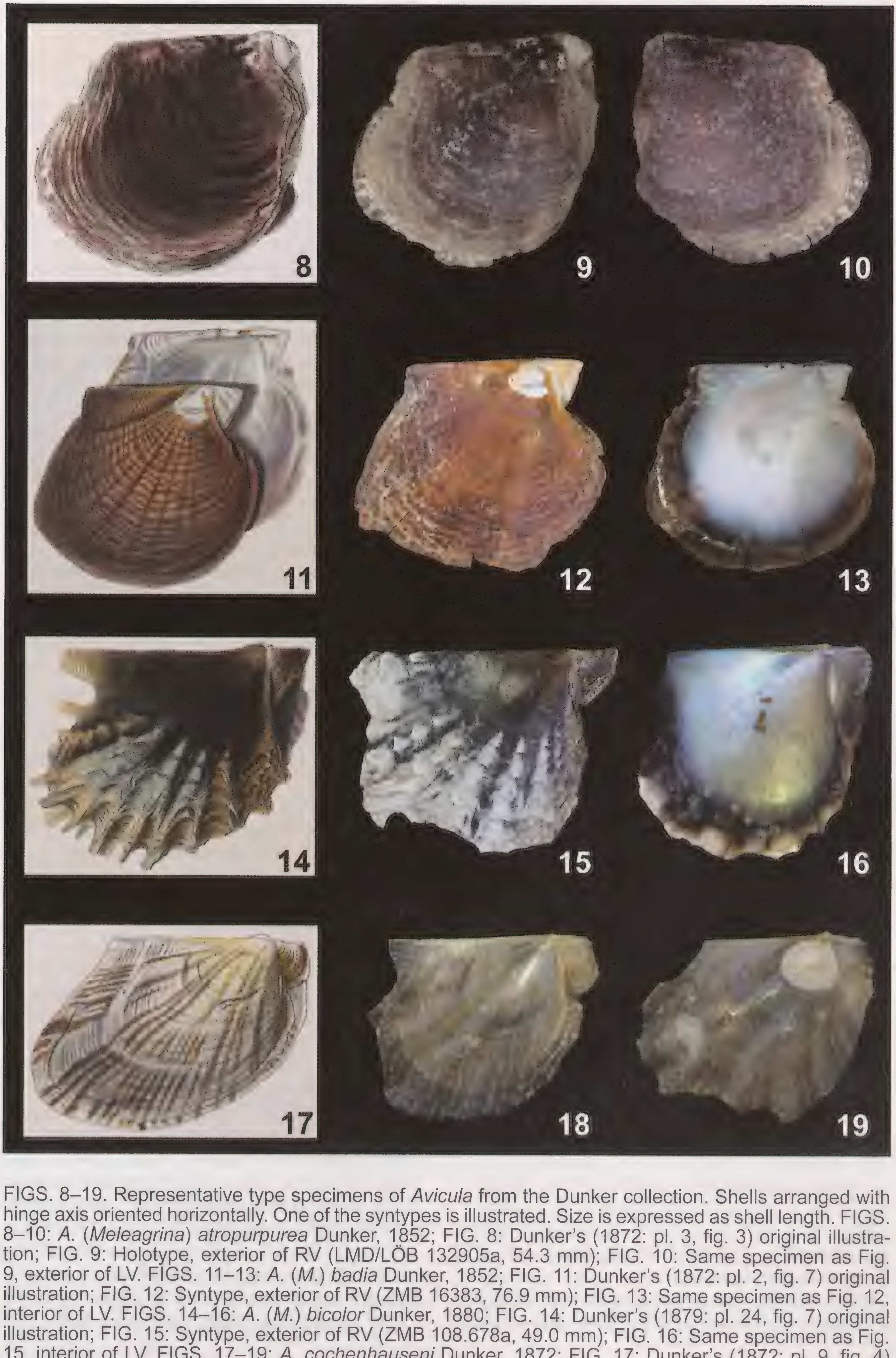
Avicula atrata Dunker, 1872 (Figs. 80–82)

Dunker, 1872: 55, 1879: pl. 19, fig. 1.

Type locality: Unknown.

Probable *syntypes:* ZMB 114.467a, one pair of articulated valves; dimensions (both valves): hinge length 70.4 mm, height 37.4 mm, length 48.7 mm; ZMB 114.467b, single RV; dimensions (RV): hinge length 80.2 mm, height 38.7 mm, length 41.1 mm.

Comments: Dunker's original description unambiguously refers to multiple specimens. One lot from the Dunker collection (ZMB 114.467) contains two very similar, most likely conspecific specimens, one pair of articulated valves and a single RV. The former is very similar to the illustrated specimen in size, overall shape, and color but slightly differs in the shape of the anterior auricle of RV and the pattern of the abraded outer shell layer in the umbonal region. It must be mentioned, however, that the depicted figure is rather generalized and lacks any features to allow establishing a definite match. This specimen matches the figure (Dunker, 1879: pl. 19, fig. 2) that immediately follows the figure of *A. atrata* but it is identified in the text as "*Avicula macroptera* Lamarck." This similarity was previously noted by Martens, who referred to both figures on his label as *A. atrata*. Martens, however, did not include his cross-like symbol to denote these specimens as types. Despite the similarity in the pattern of the fracture of the ventral margin and the color pattern, the figure shows a smaller and articulated specimen. No original Dunker's labels are preserved and, consequently, there are no indications to which species name these specimens correspond and whether they were a part of the type series of *A. atrata*. All labels are in the handwriting of Martens and must have been added later when the Dunker collection had been brought to ZMB. Consequently, for lack of definitive evidence, these specimens are considered as probable syntypes. Four labels accompany the ZMB lot:



FIGS. 8–19. Representative type specimens of *Avicula* from the Dunker collection. Shells arranged with hinge axis oriented horizontally. One of the syntypes is illustrated. Size is expressed as shell length. FIGS. 8–10: *A.* (*Meleagrina*) *atropurpurea* Dunker, 1852; FIG. 8: Dunker's (1872: pl. 3, fig. 3) original illustration; FIG. 9: Holotype, exterior of RV (LMD/LÖB 132905a, 54.3 mm); FIG. 10: Same specimen as Fig. 9, exterior of LV. FIGS. 11–13: *A.* (*M.*) *badia* Dunker, 1852; FIG. 11: Dunker's (1872: pl. 2, fig. 7) original illustration; FIG. 12: Syntype, exterior of RV (ZMB 16383, 76.9 mm); FIG. 13: Same specimen as Fig. 12, interior of LV. FIGS. 14–16: *A.* (*M.*) *bicolor* Dunker, 1880; FIG. 14: Dunker's (1879: pl. 24, fig. 7) original illustration; FIG. 15: Syntype, exterior of RV (ZMB 108.678a, 49.0 mm); FIG. 16: Same specimen as Fig. 15, interior of LV. FIGS. 17–19: *A. cochenhauseni* Dunker, 1872; FIG. 17: Dunker's (1872: pl. 9, fig. 4) original illustration; FIG. 18: Syntype, exterior of RV (ZMB 112.867, 45.6 mm); FIG. 19: Same specimen as Fig. 18, interior of LV.

Label 1: “coll. Dunker” [printed label; affixed to the interior of the single RV, ZMB 114.467b];
Label 2: “*atrata* Dkr” [handwritten by Martens; affixed to the interior of the single RV, ZMB 114.467b];
Label 3: “*atrata* / Dkr / 19. 1. 2” [handwritten by Martens];
Label 4: “cf *semisagitta* / Rv 64” [handwritten by Martens].

Avicula (*Meleagrina*) *atropurpurea* Dunker, 1852 [spelled as “*atro-purpurea*”] (Figs. 8–10)

Dunker, 1852: 76; 1872: 14, pl. 3, fig. 3.
Type locality: Unknown.
Holotype (fixed by monotypy): LMD/LÖB 132905a, one pair of articulated valves; dimensions (RV): hinge length 40.1 mm, height 51.1 mm, length 54.3 mm.
Comments: The description was based upon a unique shell – “quam colore singulare insignis” (Dunker, 1852: 76) – that warrants its designation as holotype by monotypy. The shell derives from the Scheepmaker collection (Dunker, 1852: 76), which, according to the original label, must have been in van Lennep’s collection prior its acquisition by Löbbecke. An articulated shell from the LMD/LÖB 132905a lot perfectly matches the shell (likewise depicted articulated) figured by Dunker (1872: 14, pl. 3, fig. 3) in overall shell shape, size, color, and several unique features: (1) the pattern of two dark spots and an abraded part of the umbonal region in RV; (2) the lighter colored ventral and posterior margins relative to the dark chestnut color of the shell surface in RV; (3) a distinctive notch under a weakly sinuated posterior auricle of RV; and (4) the anterior margin of LV slightly protruding anteriorly beyond the anterior margin of RV. Two labels accompany the LMD lot:
Label 1: “v. Lennep 1648 / Avicula / spec. f.” [handwritten by Löbbecke];
Label 2: “Avicula / spec. f. / 1 St. v. Lennep [handwriting unidentified] / Löbbecke-Museum” [old printed label of the Löbbecke Museum, c. 1910].

Avicula (*Meleagrina*) *badia* Dunker, 1852 (Figs. 11–13)

Dunker, 1852: 79, 80; 1872: 12, 13, pl. 2, fig. 7.
Type locality: Unknown.
Syntype: ZMB 16383, one pair of disarticulated valves with separated byssus, valves varnished; dimensions (RV): hinge length 55.3 mm, height 65.7 mm, length 76.9 mm.
Comments: The original description mentions the presence of two specimens at ZMB (Dunker, 1852: 80), but only one of the syntypes was located. The shell from the ZMB collection perfectly matches the original description and illustration by Dunker (1872) in size, shape, color, and several unique features: (1) the irregular outline of the eroded outer shell layer in the umbonal region of RV; (2) a short commarginal borehole in the exposed nacre in the umbonal region of RV; (3) the pattern of the remaining fragments of the ligament in the cardinal area of LV; and (4) the irregular outline of the damaged anterior margin ventral to the byssal notch in RV. The shell is illustrated disarticulated with LV shifted diagonally. The posterodorsal margin below the posterior auricle in LV is slightly chipped, while the anterior and ventral margins of RV are substantially damaged. Two radial fractures extend from the ventral margin. These damages were not depicted, suggesting that they had occurred at a later date. Two labels accompany the ZMB lot:
Label 1: “*Meleagrina* / badia Dkr ⁜ / Z. Mal. 1852 p 79 / Dkr Mon 2, 7 / (*Meleagrina crocata* / Swains. Zool. M. / II. tab. 55. / 16383)” [handwriting unidentified; lines 2–4 and catalogue number added by Martens at a later date];
Label 2: “*badia* Dkr ⁜” [handwritten by Martens].

Avicula (*Meleagrina*) *bicolor* Dunker, 1880 (Figs. 14–16)

Dunker, 1879: pl. 24, fig. 7 [figure without name]; 1880: 70.
Type locality: Unknown.
Syntypes: ZMB 108.678a, one pair of disarticulated valves, ventral margin of RV severely damaged; dimensions (RV): hinge length 51.2 mm, height 43.0 mm, length 49.0 mm; ZMB 108.678b, one pair of disarticulated valves; dimensions (RV): hinge length 33.9 mm, height 26.1 mm, length 28.6 mm.
Comments: The species was based on multiple specimens. One of the two shells, ZMB 108.678a, matches the original description and illustration in size, shape, color, and several unique features: (1) the unique pattern of radial tapering black stripes on the surface of RV; (2) the short and wide posterior auricle of RV with the blunt (broken off) distal extremity; and (3) the presence of wide flat scales

predominantly on the posteroventral surface of RV. The shell is depicted articulated. The specimen is markedly damaged along the ventral margin and the dorsal part of the posterior auricle, and some of the scales must have been subsequently broken off the exterior surface of RV. The second specimen in the lot is very similar to the depicted image but differs from it by very light (nearly white) color and a few faint dark colored stripes of uniform width on the posterior half of the RV surface.

Three labels accompany the ZMB lot:

Label 1: "Tab. 24. f. 7.! / *Avicula bicolor* Dkr ⁜ / Vaterland unbekannt [country of origin unknown; here translated]" [line 1 handwritten by Dunker; lines 2 and 3 handwritten by Martens; original label of the Dunker collection];

Label 2: "Mel. *radiata* / Leach / Antill. Mörch" [handwritten by Dunker; label of the Dunker collection];

Label 3: "a. *bicolor* / Dkr" [handwritten by Dunker].

Avicula brevialata Dunker, 1872 (Fig. 113)

Dunker, 1872: 55, 56, 1879: pl. 19, fig. 3; pl. 24, fig. 5 [var.]; 1880: 69 [var.]; 72 [juv.]: pl. 25, fig. 3; 1882: 229, pl. 10, figs. 3–5 [var.].

Type locality: "Habitat ad Amboinas, Moluccenses et Philippinas insulas, pariter et mare Chinense habitare dicitur" (Dunker, 1872: 56).

Type material: Not located.

Comments: Dunker gave more than one locality in the original description, which suggests that the species was based on multiple specimens. However, no shells in the Dunker collection at ZMB decidedly correspond to the single figure (Dunker, 1879: pl. 19, fig. 3) that accompanies the original description (Dunker, 1872: 55, 56), although there are several similar shells present in the collection. Dunker (1879: 56) provided the dimensions for the depicted shell (88 mm length measured between the extremities of the anterior and posterior auricles) and commented on the variability of the extent of the auricles. There are no specimens at ZMB that evidently originate from the Dunker collection with one of the localities given in the description. Therefore, the types are presumably either lost or remain unidentified at ZMB or other collections.

Several specimens of *A. brevialata* and its variety from ZMB were figured by Dunker subsequent to the original description. ZMB 112.862 contains a single pair of joined valves that match the specimen (likewise shown articulated) from Dunker's amendment of *A. brevialata* description ("specimen junius"; Dunker, 1880: 72, pl. 25, fig. 3). The correspondence between the figure and the specimen is evidenced by the outline of the abraded umbo, the slightly distally widening, dark, radial ray running along the depressed area separating the posterior auricle of RV, and the outline of the damaged posteroventral margin of LV. Also, the locality indicated on the label ("Japan") matches the text. The same specimen was also depicted in the *Index Molluscorum Maris Japonici* (Dunker, 1882: pl. 10, fig. 4). The fact that the locality was added subsequently to the original description disqualifies this shell as a probable syntype. One label accompanies ZMB 112.862:

Label: "brevialata Dkr / Ind. Moll. Taf 10 fig 4 / ~~Taf X Fig 4~~. / Dunk mon. Taf 25, fig 3 / Japan." [lines 1, 3, and 5 handwritten by Dunker; lines 2, 4 and crossed-out line 3 (probably in error) handwritten by Martens].

Another lot from the Dunker collection, ZMB 112.861, contains one pair of disarticulated valves that perfectly match the figure of another variety of *A. brevialata* (Dunker 1879: pl. 24, fig. 5) distinguished by an unusual protrusion of the anterior auricles. This is probably a teratological specimen, as evidenced by the presence of encrustation along the dorsal margin of the abnormal auricle that could have caused the abnormal pattern of shell secretion. Two labels accompany ZMB 112.861:

Label 1: "Tab 24. f. 5. [handwritten in pencil by Dunker] / brevialata Dkr var. / Dunk. monogr 24, 5!" [handwritten in ink by Martens];

Label 2: "coll. Dunker" [printed label; affixed to verso of Label 1].

ZMB 114.272 contains two shells that almost certainly represent the specimens of *A. brevialata* (juvenile) and its variety depicted by Dunker (1882: pl. 10: figs. 3 and 5 respectively). The juvenile shell matches the figure in shape, size, color, and, more importantly, in the outline of the abraded region of the umbo and the lighter coloration of the ventral margin and the anterior part of RV due to the remaining periostracum. The shell of the variety, distinguished by its yellowish color (as opposed to the characteristic chestnut color of the rest of the specimens), is similar to the depicted shell in shape, size, color, as well as the pattern of several distinct growth lines and the presence of a radial color pattern along the distal half of the depicted RV. Three labels accompany ZMB 114.272:

Label 1: "*brevialata* / Dkr ⁜ / Japan" [handwritten by Martens];

Label 2: "*brevialata* Dkr / Tab X Fig 3+5 / Japan" [handwritten by Dunker];

Label 3: "Japan!" [handwritten by Dunker].

Avicula (*Meleagrina*) *citrina* Dunker, 1852
(Fig. 70)

Dunker, 1852: 78, 79; 1872: 14, 15, pl. 3, fig. 4; 1880: 71 [var.], pl. 25, fig. 1.

Type locality: Unknown.

Type material: Not located.

Comments: None of the specimens in the Dunker collection at ZMB resemble the illustrations of articulated shells for both *A.* (*M.*) *citrina* and *A.* (*M.*) *citrina* var. Several lots in the Dunker collection at ZMB have similar shells that might have originated from the same source as the type specimens. One lot from Suez, ZMB 112.964, contains a disarticulated shell from the Dunker collection that resembles the articulated shell illustrated by Dunker (1872: pl. 3, fig. 4) in overall shape and light yellow color on most of the outer shell surface of RV. It differs from the illustration by irregular dark purple coloration along the exterior surface of the shell margins and the presence of indistinct radial white rays. Martens identified a disarticulated shell from ZMB 112.826 as "cf. *Avicula citrina* var." This specimen resembles the illustration by Dunker (1872: pl. 25, fig. 1) in overall appearance but differs from it in (1) the shape of the anterior auricle; (2) the green (as opposed to brown) color of the RV exterior; and (3) the absence of distinct fractures and a broken-off piece of the outer shell layer in the middle of RV exterior. Besides, the accompanying label neither indicates the locality, nor contains any evidence that the specimen derives from the Dunker collection. According to Dunker (1872: 14), the specimens upon which the species was based, was from the Scheepmaker collection.

Avicula cochenhauseni Dunker, 1872
(Figs. 17–19)

Dunker, 1872: 27, 28, pl. 9, fig. 4. Note: Dunker (1872: 27) erroneously refers to Figure 3 instead of Figure 4.

Type locality: "Habitat mare Chinense" (Dunker, 1872: 27).

Syntype: ZMB 112.867, one pair of disarticulated valves; dimensions (RV): hinge length 18.7 mm, height 16.2 mm, length 45.6 mm.

Comments: The species upon which the description was based were communicated by Captain Cochenhausen (Dunker, 1872: 27). The reference to the specimens in plural ("specimina") and a range of the dimensions (Dunker, 1872: 27) indicate that the name was based on multiple specimens, one of which was depicted; the other specimen(s) were not located. The depicted shell closely matches the original description and illustration in size, shape, color, and several unique features: the pattern and relative width of radial color stripes and the pattern of commarginal dark-colored stripes. The margins of both valves are severely damaged. The shell is depicted with valves articulated. Possibly due to Dunker's misprint referring to Figure 3 instead of Figure 4, Martens misidentified ZMB 108.690 as a type lot of *Avicula cochenhauseni*. None of the shells in ZMB 108.690 match the original illustration and lack any labels relating it to the Dunker collection. Two labels accompany ZMB 112.867:

Label 1: "coll. Dunker" [printed];

Label 2: "Cap. v. Cochen- / hausen." [handwritten by Dunker; original label of the Dunker collection].

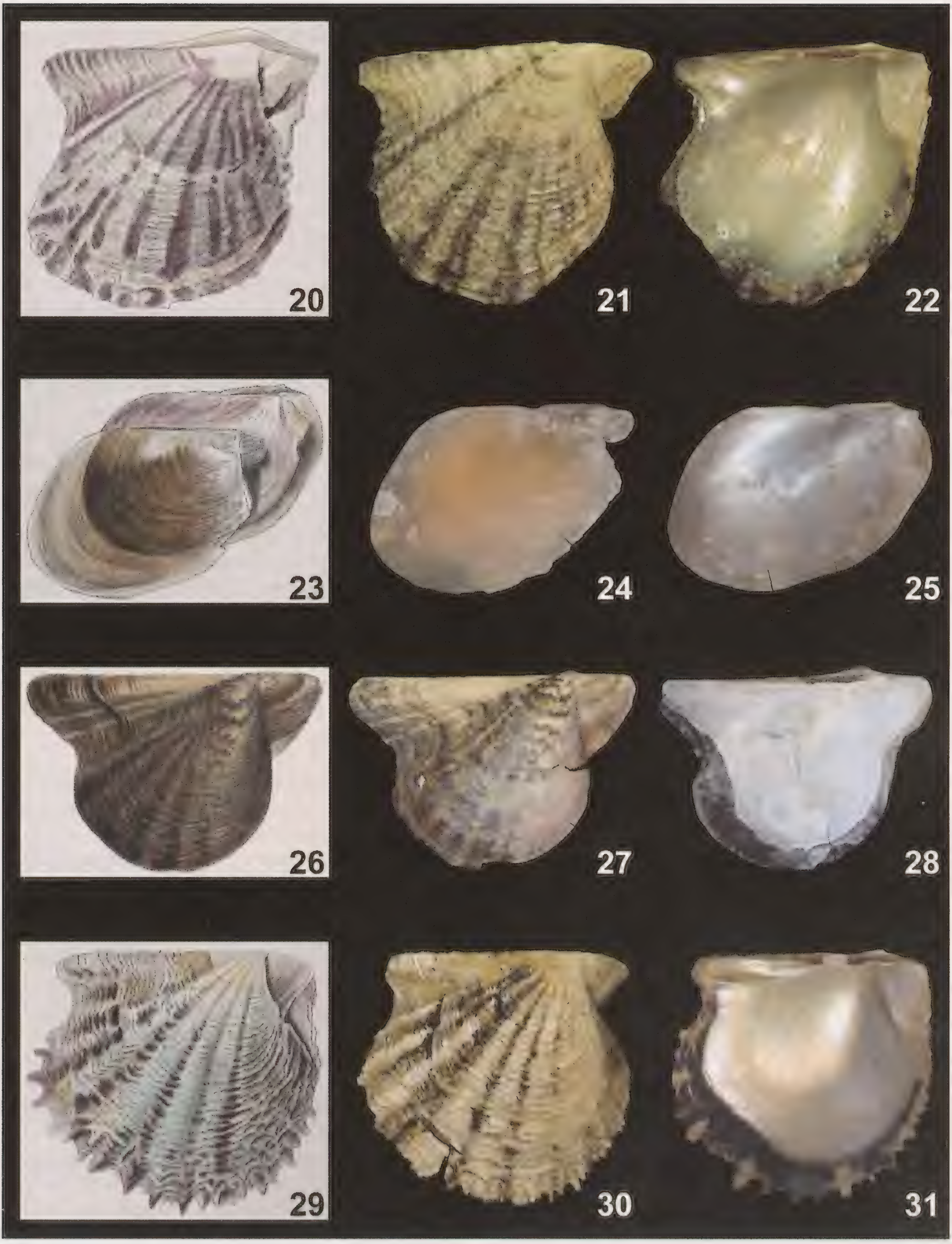
Avicula (*Meleagrina*) *concinna* Dunker, 1872
(Figs. 20–22)

Dunker, 1872: 52, pl. 18, fig. 2.

Type locality: Unknown.

Syntypes: ZMB 108.681a, one pair of disarticulated valves, ventral margin of RV damaged; dimensions (RV): hinge length 38.3 mm, height 34.0 mm, length 32.1 mm; ZMB 108.681b, one pair of disarticulated valves, posteroventral margin of LV severely damaged; dimensions (RV): hinge length 35.8 mm, height 30.5 mm, length 32.2 mm.

Comments: The species was based on multiple specimens. One of the two very similar in appearance shells from the same lot in the Dunker collection, ZMB 108.681a, matches the illustrated articulated shell in shape, size, and color and, more specifically, in (1) the width and pattern of radial dark colored rays on the RV exterior, (2) the short, oblique, dark colored stripes at the posteroventral region of the RV surface, (3) the exposed outline of the anterior margin of LV. Both shells have



FIGS. 20–31. Representative type specimens of *Avicula* from the Dunker collection. Shells arranged with hinge axis oriented horizontally. One of the syntypes is illustrated. Size is expressed as shell length. FIGS. 20–22: *A.* (*Meleagrina*) *concinna* Dunker, 1872; FIG. 20: Dunker's (1872: pl. 18, fig. 2) original illustration; FIG. 21: Syntype, exterior of RV (ZMB 108.681a, 32.1 mm); FIG. 22: Same specimen as Fig. 21, interior of LV. FIGS. 23–25: *A. cornea* Dunker, 1852; FIG. 23: Dunker's (1872: pl. 10, fig. 6) original illustration; FIG. 24: Syntype, exterior of RV (LMD/LÖB 124300a, 34.7 mm); FIG. 25: Same specimen as Fig. 24, interior of LV. FIGS. 26–28: *A. fluctuosa* Dunker, 1880; FIG. 26: Dunker's (1880: pl. 25, fig. 2) original illustration; FIG. 27: Syntype, exterior of RV (ZMB 112.864, 38.0 mm); FIG. 28: Same specimen as Fig. 27, interior of LV. FIGS. 29–31: *A.* (*M.*) *horrida* Dunker, 1872; FIG. 29: Dunker's (1872: pl. 15. fig. 2) original illustration; FIG. 30: Syntype, exterior of RV (ZMB 101.673, 54.7 mm); FIG. 31: Same specimen as Fig. 30, interior of LV.

damaged margins. Three labels accompany the ZMB lot:
Label 1: "coll. Dunker" [printed];
Label 2: "*Avicula papi- / lionacea* Lam. / ? / Pfr. / 5." [handwritten by Dunker; label of the Dunker collection];
Label 3: "*concinna* Dkr / ⁜ / mon. 18, 2" [handwritten by Martens].

Avicula cornea Dunker, 1852 (Figs. 23–25)

Dunker, 1852: 74; 1872: 33, 34, pl. 10, fig. 6.
Type locality: Unknown.
Syntype: LMD/LÖB 124300a, one pair of disarticulated valves; dimensions (RV): hinge length 23.6 mm, height 26.4 mm, length 34.7 mm.
Comments: The description was based on multiple specimens, as evidenced by the range of dimensions original provided. A specimen from LMD/LÖB 124300a, that derived from the Scheepmaker collection, perfectly matches the illustration by Dunker (1872: pl. 10, fig. 6) in overall shell shape, size, color, and several unique features: (1) the presence of light-colored encrusted area posterior to the umbo in RV; (2) a commarginal pattern of the abraded area in the umbonal region of RV; and (3) a notch in the margin of the nacreous layer ventral to the anterior auricle in LV. Four labels accompany the LMD lot:
Label 1: "Scheep [handwritten in ink by Löbbecke] / D / habitat cornea / inconnu / ~~membrana~~ / ~~cea Dkr~~" [handwritten in pencil by Dunker];
Label 2: "Scheep [handwritten in ink by Löbbecke] / spadicea / var / Rothes Meer" [handwritten in pencil by Dunker];
Label 3: "Avicula / spadicea Dkr. / Var. / Rotes Meer / 1 St. Scheepm. [handwriting unidentified] / -Museum" [old printed label of the Löbbecke Museum, c. 1910];
Label 4: "Avicula Cornea DKR. / holotyp leg. Scheepmaker / 124300a [handwritten by Boscheinen] / Löbbecke-Museum [printed]."

Avicula coturnix Dunker, 1879 (Figs. 83–85)

Dunker, 1879: 67, pl. 23, figs. 4, 5; 1882: 228, pl. 10, figs. 1, 2.
Type locality: "Mare Japoniae mediterraneum" (Dunker, 1879: 67).
Syntypes: ZMB 108.689a, one pair of articulated valves, ventral margins of both valves damaged; dimensions (both valves): hinge length 37.0 mm, height 11.1 mm, length 22.2 mm; ZMB 108.689b, one pair of disarticulated valves, ventral margins and posterior auricles of both valves damaged; dimensions (RV): hinge length 30.3 mm, height 11.5 mm, length 17.7 mm.
Comments: The species was based on multiple specimens. The articulated shell, ZMB 108.689a, closely matches the original description and illustration size, shape, color, and the unique features of coloration: (1) a noticeably wider spacing between the two most distal dark stripes at the tip of the posterior auricle in LV; (2) a denser and darker colored pattern of brown blotches along the ventral margin, especially at the posteroventral extremity of LV; and (3) a wide commarginal stripe in the middle of RV. In the depicted shell, the margins appear intact, whereas in the actual specimen they are damaged in both valves, but less so in LV. The disarticulated shell, ZMB 108.689b, was illustrated by Dunker in a later publication (1882: pl. 10, figs. 1, 2). The specimen closely resembles the illustration by the pattern of wide, commarginal, arch-like blotches in both valves. In its present condition, the shell is substantially damaged along margins of both valves and the posterior auricles. Five labels accompany the ZMB lot:
Label 1: "coll. Dunker" [printed label];
Label 2: "*coturnix* Dkr / mon 23, 3. 4 ! / ind. moll Jap. 10, 1. 2" [handwritten by Martens];
Label 3: "*coturnix* / Dkr ⁜" [handwritten by Martens];
Label 4: "Japan!" [handwritten by Dunker];
Label 5: "Av. pen- / nata Dkr." [handwritten by Dunker].

Avicula cypsellus Dunker, 1872 (Figs. 86–88)

Dunker, 1872: 25, 26, pl. 8, fig. 4.
Type locality: "Habitat in Oceano Indico fide beato Scheepmaker" (Dunker, 1872: 25).
Syntype: LMD/LÖB 132969a, one pair of disarticulated valves; dimensions (RV): hinge length 94.3 mm, height 43.7 mm, length 51.7 mm.
Syntype: The figured shell is from the Scheepmaker collection. Despite the fact that the original description does not mention the presence of multiple specimens and provides the dimensions for the "exemplar depictum" (Dunker, 1872: 25), it does not contain an explicit statement that it was based on a single

specimen. LMD/LÖB 132969a contains a disarticulated specimen that perfectly matches the original description and illustration in size, shape, color, and several unique features: (1) the pattern of the abraded outer shell layer at the umbonal region, the anterior auricle, and the anterodorsal part of RV; (2) the shape of unusually protruded anterior auricle; and (3) a light-colored ray separating the valve from the posterior auricle. No original labels accompanied the LMD lot.

Avicula (*Meleagrina*) *echinus* Dunker, 1872 (Fig. 71)

Dunker, 1872: 40, 41, pl. 13, fig. 2.

Type locality: "Habitat in portu ad Habanam" (Dunker, 1872: 40).

Type material: Not located.

Comments: The depicted specimen derives from the Gundlach collection. A reference to "diese kleine Muschel" ("this tiny shell"; Dunker, 1872: 41; here translated) in the original description indicates that the description was probably based on a single specimen, although this assumption could not be verified.

Avicula (*Meleagrina*) *fimbriata* Dunker, 1852 (Figs. 72, 73)

Dunker, 1852: 79; 1872: 13, 14, pl. 3, figs. 2, 6.

Type locality: "Patria America centralis dicitur" (Dunker, 1852: 79).

Type material: Not located.

Comments: The description was based on multiple specimens as evidenced by the range of dimensions provided in the original description. The location of the type material is unknown.

Avicula fluctuosa Dunker, 1880 (Figs. 26–28)

Dunker, 1880: 71, 72, pl. 25, fig. 2.

Type locality: Unknown.

Syntype: ZMB 112.864, one pair of disarticulated valves; dimensions (RV): hinge length 55.4 mm, height 37.8 mm, length 38.0 mm.

Comments: The original description does not contain an explicit statement that it was based on a single specimen and does not include shell dimensions. A single shell present in the type lot closely corresponds to the figure accompanying the original description. The shell matches the illustration in size, shape, color, and two unique features: a large anterior auricle with a distinct pattern of growth accretion separating the surface of the auricle into tree parts and the pattern of commarginal dark stripes, which become more zigzagged in the anterior half of the RV exterior surface. The ventral margin of RV is slightly more damaged than depicted and bears a fracture, extending from the area directly underneath the anterior auricle to approximately the middle of the valve. The original description does not indicate type locality ("patria ignota"). However, most labels (including those in Dunker's handwriting) contain the locality "Australia," possibly due to the specimen's resemblance to the Australian shell described by Reeve (1857, sp. 73, pl. 18, fig. 69) as *Avicula atlantica* Lamarck, 1819, the reference to which also appears on the labels.

Five labels accompany the ZMB lot:

Label 1: "coll. Dunker" [printed label];

Label 2: "*atlantica* Lam / Reeve T. 18. sp. / 73, f. 69 / 'Australia Jukes'" [handwritten by Dunker];

Label 3: "Australia / cf *sterna* A Gould / (*heteroptera* Rv 67" [handwritten by Martens];

Label 4: "Zoologisches Museum Berlin. [printed] / Australien Dunker" [handwriting unidentified; typical ZMB collection label].

Avicula (*Meleagrina*) *grisea* Dunker, 1872 (Fig. 74)

Dunker, 1872: 11, 12, pl. 2, fig. 5.

Type locality: Unknown.

Type material: Not located.

Comments: The original description does not contain an explicit statement that it was based on a single specimen and does not include shell dimensions. The location of the type material is unknown.

Avicula gruneri Dunker, 1872 (Fig. 114)

Dunker, 1872: 51, 52, pl. 18, fig. 1.

Type locality: Unknown.

Type material: Not located.

Comments: The original description does not contain an explicit statement that it was based on a single specimen and does not include shell dimensions. Dunker (1872: 51, 52) indicated that the figured specimen came from the Gruner collection. The location of the type material is unknown and presumed to be either lost or unidentified at the GSUB, LMD, or SMF collections.

Avicula (*Meleagrina*) *horrida* Dunker, 1872 (Figs. 29–31)

Dunker, 1872: 11, pl. 2, fig. 4; 46, pl. 15. fig. 2.

Type locality: “Habitat in litore Venezuelensi prope Cumanam nec non in Antillis insulis” (Dunker, 1872: 11).

Syntype: ZMB 101.673, one pair of disarticulated valves; dimensions (RV): hinge length 48.8 mm, height 49.0 mm, length 54.7 mm.

Comments: The species was based on multiple specimens. The shell from the Gruner collection depicted on Dunker’s pl. 2 was not located. The specimen from the ZMB collection (ZMB 101.673) perfectly matches the original description and the second figure (pl. 15, fig. 2) in size and shape, and, more importantly, in the pattern of purple radial rays and two large dark spots at the posterior part of RV exterior surface. Three labels accompany the ZMB lot:

Label 1: “*Avicula horrida* Dunk / Dunk. Taf. 15 fig 2! p. 46 / Venezuela” [handwritten by Martens];

Label 2: “*horrida* Dkr ⁜” [handwritten by Martens];

Label 3: “Zoologisches Museum Berlin. [printed] / Puerto *horrida* / (Dunker) * / 101 673 / Venezuela” [handwritten by Rudolf Kilias].

Avicula hyalina Dunker, 1852 (Figs. 32–34)

Dunker, 1852: 75; 1872: 32, 33, pl. 10, figs. 3, 4.

Type locality: “Insula Van Diemen; attulit ornat. Schayer” (Dunker, 1852: 75).

Syntypes: ZMB 108.692a, one pair of disarticulated valves, margins of both valves damaged; dimensions (RV): hinge length 16.6 mm, height 16.2 mm, length 20.0 mm; ZMB 108.692b, one pair of disarticulated laves, RV broken, posteroventral margin of LV severely damaged, pieces enclosed; dimensions (RV): hinge length 14.6 mm, height 16.5 mm, length 22.2 mm; ZMB 108.693, two disarticulated pairs and one RV, all specimens severely damaged; dimensions (RV): hinge length 13.1–16.3 mm, height 12.5–17.2 mm, length 19.1–22.2 mm.

Comments: The original description was based on the material from ZMB, as stated by Dunker (1852: 75, “Schayer. Exstat in Museo Berol”). The lot contains the original label that mentions the name “Schayer,” which is also referred to in the original description. However, none of the specimens from the ZMB collection unambiguously match the illustrations. The shells in ZMB 108.692a are very similar to the depicted specimens in shape and size, but the pattern of commarginal color stripes does not match with certainty. It must be noted that the illustrations are quite unspecific and might be not entirely accurate representations of the extant specimens; it is possible that the illustrations are composite images. The same observations hold for the ZMB 108.693 lot. Two label accompany ZMB 108.692a,b:

Label 1 (recto): “*Meleagrina* / *Avic hyalina* ⁜ / Dkr / Z Mal 1852 p. 25 / cf *perviridis* Rv / Zettel lag daneben, / müßte in diese / Schachtel gehören! / Vandiemsland. [with label aside, / probably belongs into this box / Vandiemsland (=Tasmania); here translated] / Schayer.” [lines 1, 2, 3, 9, 10 handwriting unidentified; asterisk and lines 4 and 5 subsequently added by Martens; lines 6–8 subsequently added, handwriting attributed to Rudolf Kilias; original ZMB label];

Label 1 (verso): “~~Meleagrina~~ / ~~spec~~. / ~~Vandiemsland~~. / ~~Schayer~~.” [handwriting unidentified].

Label 2: “Tasm. / hyalina Dkr. / ⁜ / Dkr. 10,4” [handwritten by Martens].

One label accompanies ZMB 108.693:

Label: “Meleagrina [handwritten in pencil, attributed to Dunker] / hyalina, Dkr. [handwritten in black ink by Martens] / Vandiemsland Schäyer.” [handwritten in brown ink, attributed to Dunker].

Avicula jamaicensis Dunker, 1879

Avicula cornea Reeve, 1857: Species 73, pl. 17, fig. 73; Dunker, 1879: 65, pl. 22, fig. 10.

Type locality: “Jamaica” (Reeve, 1857).

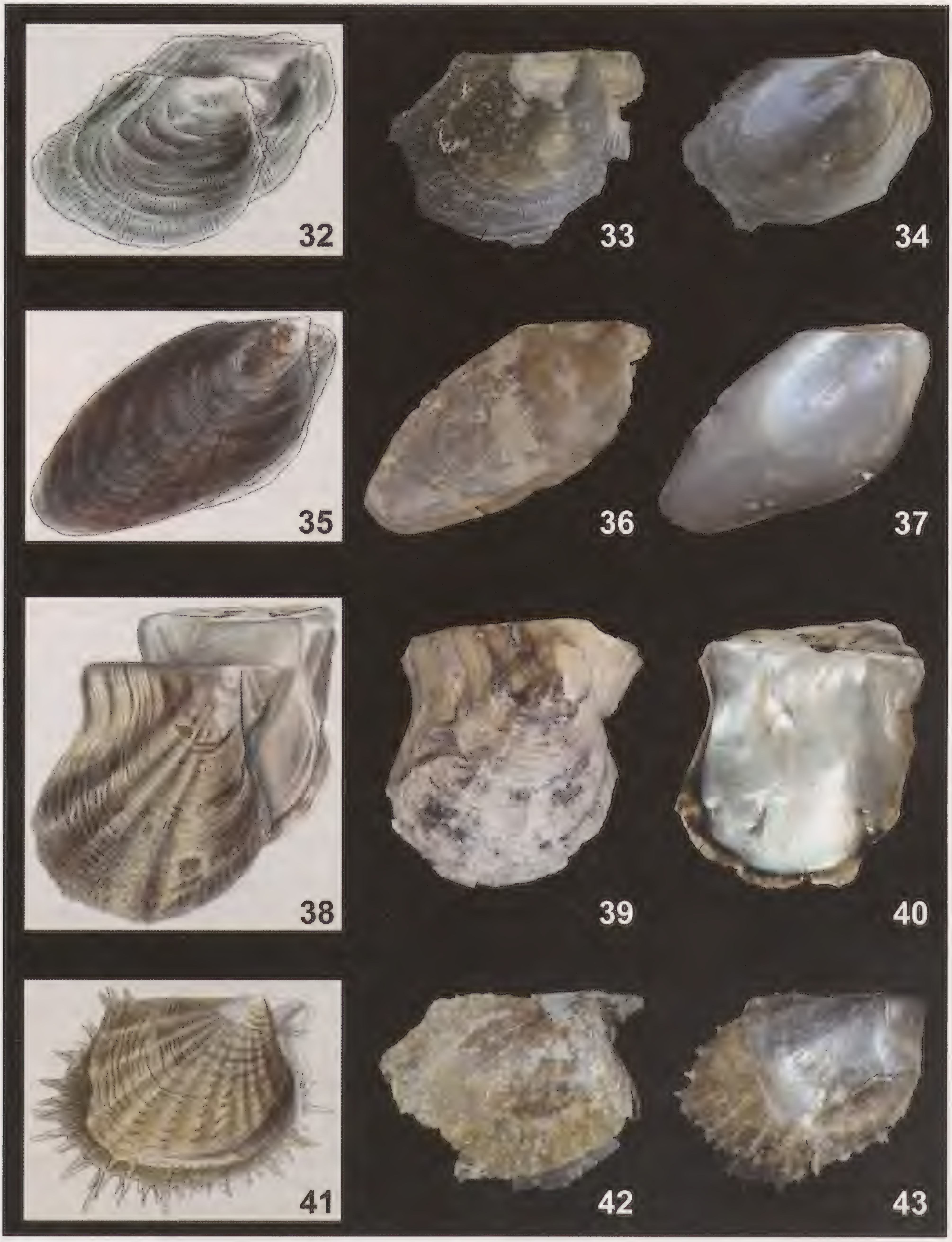
Comments: A. jamaicensis is a substitute name for *A. cornea* Reeve, 1857, a junior primary homonym of *Avicula cornea* Dunker, 1852. The illustration was based on the specimen from the Cuming collection figured by Reeve (1857: pl. 17, fig. 73). The original Reeve figure shows the specimen attached to coral, whereas Dunker did not illustrate the coral.

Avicula japonica Dunker, 1852 (Figs. 35–37)

Dunker, 1852: 73, 74; 1872: 33, pl. 10, fig. 5; 1882: 230.

Type locality: “Haec species incola est maris Japonici” (Dunker, 1852: 74).

Holotype (fixed by monotypy): LMD/LÖB 124280a, one pair of disarticulated valves; dimensions (RV): hinge length 18.1 mm, height 30.0 mm, length 38.9 mm.



FIGS. 32–43. Representative type specimens of *Avicula* from the Dunker collection. Shells arranged with hinge axis oriented horizontally. One of the syntypes is illustrated. Size is expressed as shell length. FIGS. 32–34: *A. hyalina* Dunker, 1852; FIG. 32: Dunker's (1872: pl. 10, fig. 4) original illustration; FIG. 33: Syntype, exterior of RV (ZMB 108.692a, 20.0 mm); FIG. 34: Same specimen as Fig. 33, interior of LV. FIGS. 35–37: *A. japonica* Dunker, 1852; FIG. 35: Dunker's (1872: pl. 10, fig. 5) original illustration; FIG. 36: Holotype, exterior of RV (LMD/LÖB 124280a, 38.9 mm); FIG. 37: Same specimen as Fig. 36, interior of LV. FIGS. 38–40: *A.* (*Meleagrina*) *lichtensteini* Dunker, 1852; FIG. 38: Dunker's (1872: pl. 2, fig. 3) original illustration; FIG. 39: Syntype, exterior of RV (ZMB 16.376a, 46.5 mm); FIG. 40: Same specimen as Fig. 39, interior of LV. FIGS. 41–43: *A.* (*M.*) *longisquamosa* Dunker, 1852; FIG. 41: Dunker's (1872: pl. 2, fig. 6) original illustration; FIG. 42: Syntype, exterior of RV (ZMB 101.674, 35.9 mm); FIG. 43: Same specimen as Fig. 42, interior of LV.

Comments: The phrase “Singularis sane forma” in the original description (Dunker, 1852: 74) and the word “Original” that appears on the labels written by Dunker and Löbbecke warrant the designation of the extant specimen as holotype by monotypy. The shell derives from the Scheepmaker collection that had later become part of the Löbbecke collection (Dunker, 1852: 74; 1882: 230). The shell from the LMD collection closely matches the figure by Dunker (1872: pl. 10, fig. 5) in size, shape, color, and two unique features: a dark spot immediately posterior to the umbo in RV and a small anteriorly protruding part of the anterior margin of RV. The shell is figured articulated. See additional comments on the misuse of the name “japonica” in the entry for *Avicula* (*Meleagrina*) *martensii* Dunker, 1880. Five labels accompany the LMD lot:

Label 1: “Scheepm. 1124 / Avicula / japonica Dunker / Original / Dunker Mart. Chem. / T. 10 f. 5” [handwritten by Löbbecke];
Label 2: “japan / japonica Dk / ~~cornea Dkr~~” [handwritten by Dunker];
Label 3: “japonica Dkr. / Original.” [handwritten by Dunker];
Label 4: “Avicula / japonica Dkr. / 1 [handwriting unidentified] Löbbecke-Museum” [old printed label of the Löbbecke Museum, c. 1910];
Label 5: “Avicula japonica DUNKER / 1 Ex. / Vorlage z.d. Abb. i. M. u. Ch. / Bd.VII,3. Taf. 10, Figur 5. [typed] / Löbbecke-Museum” [printed].

Avicula jeffreysii Dunker, 1880 (Figs. 89–91)

Dunker, 1879: pl. 24, fig. 3 [figure without name]; 1880: 69.

Type locality: “Litus Guineense teste mercatore, qui speciem venalem habuit” (Dunker, 1880: 69).

Syntype: ZMB 108.691, one pair of disarticulated valves; dimensions (RV): hinge length 74.2 mm, height 36.8 mm, length 39.5 mm.

Comments: The original description does not contain an explicit statement that the species was based on a single specimen and does not provide the dimensions. ZMB 108.691 contains a single shell that closely corresponds to the figure accompanying the original description in size, shape, color, and two unique features: the irregular pattern of radial and commarginal dark stripes on the exterior of RV and the light-colored S-shaped stripe in the middle of the posterior auricle. The posteroventral part of the valve is broken off but is enclosed with the specimen. Omitted from the illustration is a large encrustation at the proximal part of the posterior auricle of RV. Five labels accompany the ZMB lot:

Label 1: “coll. Dunker” [printed label];
Label 2: “Tab. 24. fig. 3.” [handwritten by Dunker];
Label 3: “*jeffreysii* / Dkr ⁜ / Taf 24 fig 3 / Guinea” [lines 1, 2 handwritten by Dunker; asterisk and lines 3, 4 handwritten by Martens];
Label 4: “*jeffreysii* / Dkr ⁜” [handwritten by Martens];
Label 5: “78 / *Avicula semi* / *sagitta* / Lam Afrique” [handwriting unidentified].

Avicula (*Meleagrina*) *lichtensteini* Dunker, 1852 (Figs. 38–40)

Dunker, 1852: 77; 1872: 10, pl. 2, fig. 3.

Type locality: “Insulae Sandwich” (Dunker, 1852: 77).

Syntypes: ZMB 16.376a, one pair of disarticulated valves; dimensions (RV): hinge length 49.3 mm, height 56.6 mm, length 46.5 mm; ZMB 16.376b, one pair of disarticulated valves with RV ventral margin severely damaged; dimensions (LV): hinge length 50.0 mm, height 65.6 mm, length 59.4 mm; ZMB 976, soft body in alcohol.

Comments: The description was based on the material housed at ZMB (Dunker, 1852: 77, “Musaeo Berol.”; 1872: 10, “Exstat in collectione rerum naturalium regio Berolinensi”). Martens marked ZMB 16.376 as the type lot. One of the two shells, ZMB 16.376a, resembles the illustrated shell in overall shape and the pattern of dark blotches in near-umbonal region. It differs, however, from the depicted shell by having an angle formed by the dorsal margin and the anterior auricles. (The illustration shows the anterior auricle continuous with the straight hinge line.) The second shell from the same lot is similar to the figured shell in the pattern of the remaining part of the ligament in LV and the overall shape of the dorsal half of the shell (the ventral part of RV is missing), but differs from it by the lack of the distinct dark brown blotches (present in the other specimen). It is possible that the illustration is a composite of the two shells from the type lot; however this claim is difficult to substantiate. Another lot, ZMB 976, labeled as “*Avicula margaritifera* from Sandwich Islands, leg. Deppe,” contains soft tissues in alcohol that correspond to the shells from ZMB 16.376. Three labels accompany ZMB 16.376:

Label 1: "*Meleagrina* / ⁜ / *lichtensteinii* Dkr / Z. Mal. 1852. p 77 / *A. nebulosa* Conrad / Rv 33 / Sandwichs-Inseln / Deppe / 16376" [lines 1, 3, 6, 7 handwriting unidentified; lines 2, 4, 5, 8, 9 added subsequently by Martens];

Label 2: "Sandwich / *nebulosa* Conr / *lichtensteini* Dkr ⁜" [handwritten by Martens];

Label 3: "Zoologisches Museum Berlin. [printed] / Sandwich Ins Deppe" [handwritten by Rudolf Kilias].

Avicula (*Meleagrina*) *longisquamosa* Dunker, 1852 (Figs. 41–43)

Dunker, 1852: 76, 77; 1872: 12, pl. 2, fig. 6.

Type locality: "Litus Venezuelense ad Porto Cabello" (Dunker, 1852: 77).

Syntype: ZMB 101.674, one pairs of disarticulated valves with byssus attached to RV; dimensions (RV): hinge length 24.9 mm, height 28.2 mm, length 35.9 mm.

Comments: Previously, Mikkelsen et al. (2004) regarded the only specimen in the type lot as holotype. However, the absence of the expressed unambiguous statement that the original description was based a single specimen or any other definitive evidence renders it a syntype. A photograph of the syntype and the corresponding illustration (both shown in the same orientation) were published in color as figs. 2 and 3, respectively, by Mikkelsen et al. (2004: 477).

The specimen was received by Dunker from Tams (Dunker, 1852: 77; 1872: 12). The shell from the ZMB collection perfectly matches the original description and the illustration in size and shape, and several unique features: (1) the presence of the byssus; (2) the outline of the incrusted area posterior to umbo in RV; (3) the pattern of radial light-colored rays; and (4) the shape and the extent of the anterior auricle in RV. A slight discrepancy in the exterior valve surface color between the specimen and the figure is most likely due to the deteriorative changes in both the shell and the paper. The shell is depicted articulated with the byssus produced through the byssal notch. Both valves of the actual specimen are severely marginally damaged and most long marginal scales are broken off, as in the original illustration. According to a label by Rudolf Kilias, LV was broken and repaired. Three labels accompany the ZMB lot:

Label 1: "Avicula. / Porto Cabello. / Dr. G. Tams." [handwritten by Dunker on a green paper slip];

Label 2: "coll. Dunker" [printed; affixed to verso of Label 1];

Label 3 (recto): "Zoolog. Museum Berlin [printed] / Typ.-Mat. [handwritten in pencil] / Holotypus [handwritten in blue ink] / longisquamosa / Dunker [handwritten in pencil] / 101 674 [handwritten in blue ink] / leg. Tams [handwritten in pencil] / Puerto Cabello [handwritten in black ink] / Coll. [handwritten in pencil] Dunker" [handwritten in black ink] [notes in pencil and blue ink handwritten by Ingeborg Kilias; notes in black ink are typical ZMB labels handwritted by unidentified person];

Label 3 (verso): "war gebrochen, / geklebt! [was broken, / glued; here translated] / V. 1972" [handwritten by Ingeborg Kilias].

Avicula loveni Dunker, 1879 [spelled as "*Lovéni*"] (Figs. 3, 4)

Dunker, 1879: 67, pl. 23, fig. 6; Dunker, 1882: 229, pl. 10, fig. 6.

Type locality: "Mare Japoniae mediterraneum" (Dunker, 1879: 67).

Syntype: ZMB 108.679, one pair of disarticulated valves; dimensions (RV): hinge length 57.3 mm, height 28.2 mm, length 26.4 mm.

Comments: The original description does not contain an explicit statement that the species was based on a single specimen and does not provide the dimensions. The single shell in the type lot closely corresponds to the figure accompanying the original description. The shell closely matches the original description and illustration size, shape, color, and several specific details: (1) the distinct, sharply defined pattern of dark coloration of the posterior auricle of RV; (2) the pattern of dark commarginal lines on the exterior of RV; and (3) the presence of dark lines on the inner posteroventral margin of LV. The shell is depicted disarticulated with LV shifted upward. The same shell was illustrated by Dunker in a later publication (Dunker, 1882: 229, pl. 10, fig. 6), but shown articulated and somewhat more generalized. Also, unlike the original illustration, the later figure shows a damaged ventral margin, suggesting that it has been made from the same specimen at a later date rather than being copied from the original figure. Three labels accompany the ZMB lot:

Label 1: "coll. Dunker" [printed label];

Label 2: "*Loveni* Dkr / ind moll Jap / Taf X Fig 6. / Dkr monogr 23, 6 / Japan" [lines 1, 3, and 5 handwritten in brown ink by Dunker;

lines 2 and 3 in blue ink were added by Martens at a later date];

Label 3: “⁜ / *Loveni* Dkr / Japan” [handwritten by Martens].

Avicula (*Meleagrina*) *martensii* Dunker, 1880
(Figs. 44–46)

Dunker, 1879: 66 [per erratum *Avicula* (*Meleagrina*) *japonica*], pl. 23, figs. 2, 3; 1880: 79, 81, 84; 1882: 229, pl. 10, figs. 7, 8.

Type locality: “Mare Japonicum” (Dunker, 1879: 66).

Syntypes: ZMB 108.685, one pair of disarticulated valves; dimensions (RV): hinge length 59.2 mm, height 63.3 mm, length 57.9 mm; ZMB 108.683, one pair of disarticulated valves; dimensions (RV): hinge length 58.2 mm, height 62.8 mm, length 60.0 mm; ZMB 108.684a, one pair of disarticulated valves; dimensions (RV): hinge length 49.7 mm, height 48.2 mm, length 43.8 mm; ZMB 108.684b, one pair of disarticulated valves, anteroventral margin of RV damaged; dimensions (LV): hinge length 56.3 mm, height 46.3 mm, length 50.0 mm.

Comments: Dunker originally described and illustrated this species as “*Avicula* (*Meleagrina*) *japonica*,” the name he had established earlier for a different species, *Avicula japonica* Dunker, 1852. Subsequently Dunker expressly admitted the error (Dunker, 1880: 79, 81, 84; 1882: 229) and proposed a replacement name – *martensii* – for the junior primary homonym in the following year (Dunker, 1880: 79).

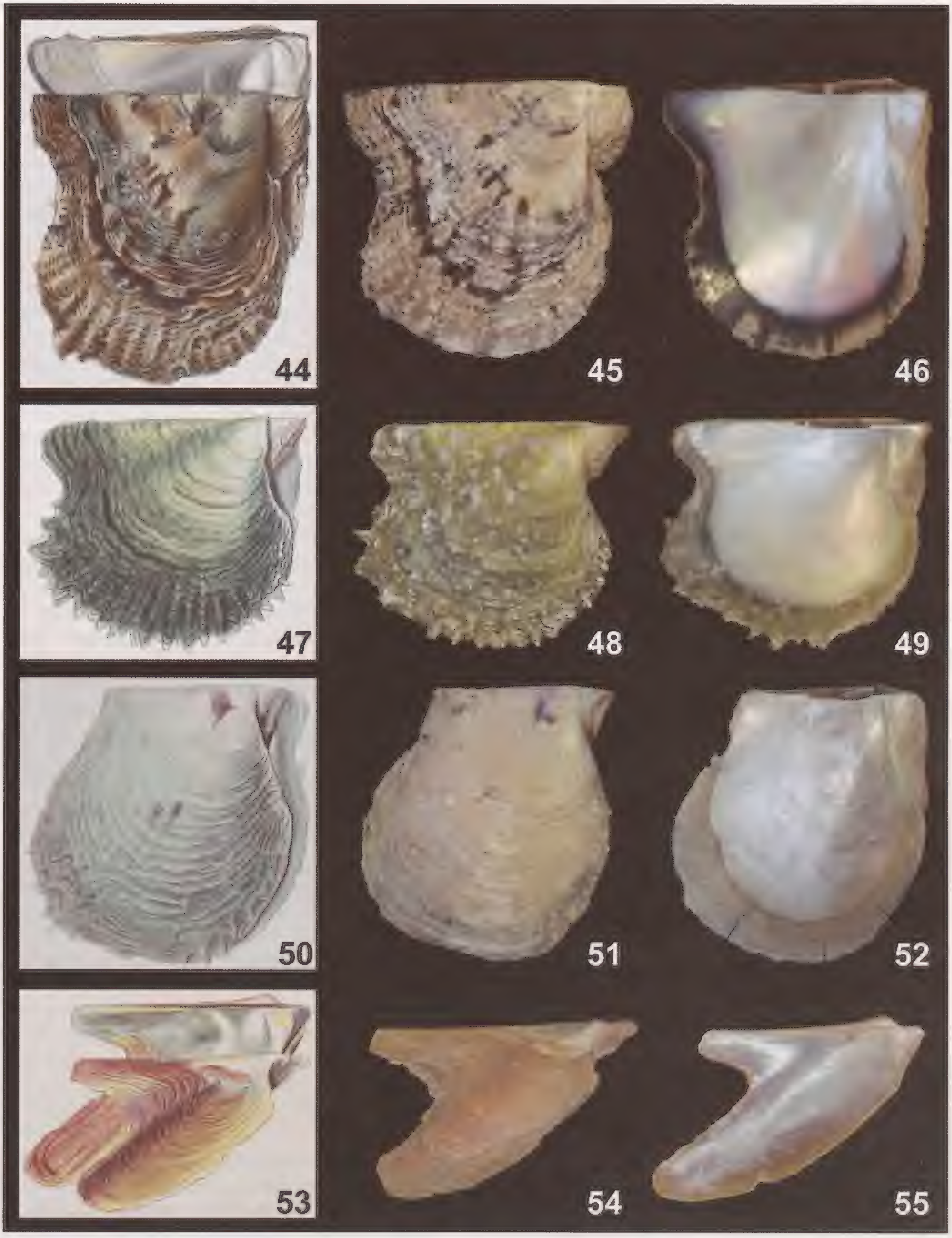
The species was based on multiple specimens. All the extant specimens appear to be conspecific. The shells in ZMB 108.683 and ZMB 108.685 from the Dunker collection contain labels with the phrase “original,” suggesting that these could have been the first specimens of this species obtained by Dunker. The figures of *A.* (*M.*) *martensii* from a later publication (Dunker, 1882: pl. 10, figs. 7, 8) were reproduced in color by Shirai (1994: 28).

The shell from ZMB 108.685 lot perfectly matches the original description and illustration in Dunker (1879: pl. 23, fig. 2) in size, shape, color, and several unique features: (1) the outline of the abraded outer shell layer at the umbonal region and the submarginal area slightly posterior to the middle of the hinge line in RV; (2) the pattern or radial, commarginal, and irregular dark brown coloration on RV exterior; (3) the presence of the distinct thick commarginal growth line separating RV in the middle into distal and proximal halves (this feature is somewhat exaggerated in the figure); and (4) the concave outline of the ventral margin of anterior auricle in RV. The shell is depicted disarticulated in a staggered fashion with LV shifted upward. Part of the ligament in LV and the posteroventral margin of RV are damaged in the actual specimen. The same shell was later redrawn by Dunker (1882: pl. 10, fig. 7). The original illustration shows LV overlapped by RV, the former shifted slightly upward, so that the hinge area can be observed. In the figure made for a later publication, the shell is portrayed slightly differently, showing LV shifted diagonally, so that a larger part of the interior surface of LV is revealed. This later illustration also distinctly shows the damage of the ligament in two places in the resilifer in LV, the broken scales at the posteroventral margin of RV, and more extensively abraded outer shell layer in the posterodorsal region along the hinge line. Both of these features were not present in the original illustration despite similar level of detail, suggesting that the shell was indeed re-drawn (rather than the illustration copied) for the later publication. Two labels accompany ZMB 108.685:

Label 1: “*Avicula martensi* Dkr / Original. / Japan / Original zu Dunk Avicula / Taf 23 Fig 2 !” [handwritten by Martens except line 2 handwritten by Dunker];

Label 2: “Japan” [handwritten by Dunker].

ZMB 108.684a perfectly matches the figure by Dunker (1879: pl. 23, fig. 3) in size, shape, color, and several distinct features: (1) the short, dorsoventrally extended anterior auricle of RV; (2) the pattern of irregularly distributed dark brown blotches on RV exterior surface; (3) the commarginal dark brown stripe in the middle of RV; (4) the transverse light brown striations on the surface of flat overlapping scales distal to the dark brown commarginal stripe; and (5) the outline of a slightly damaged posteroventral margin of RV. The shell is depicted disarticulated in a staggered fashion with LV shifted upward. The second specimen in the same lot, ZMB 108.684b, is a disarticulated shell and is similar to the other specimen. Currently, both specimens are contained in the same container with by two labels, one containing the name “Lischke” and the other containing the name “Löbbecke.” Both names were written by Dunker. If Martens’ additional annotations on these labels are correct, the



FIGS. 44–55. Representative type specimens of *Avicula* from the Dunker collection. Shells arranged with hinge axis oriented horizontally. One of the syntypes is illustrated. Size is expressed as shell length. FIGS. 44–46: *A.* (*Meleagrina*) *martensii* Dunker, 1880; FIG. 44: Dunker's 1879: pl. 23, fig. 3) original illustration; FIG. 45: Syntype, exterior of RV (syntype; ZMB 108.684a, 43.8 mm); FIG. 46: Same specimen as Fig. 45, interior of LV. FIGS. 47–49: *A.* (*M.*) *olivacea* Dunker, 1872; FIG. 47: Dunker's (1872: pl. 4, fig. 5) original illustration; FIG. 48: Syntype, exterior of RV (ZMB 101.672, 55.8 mm); FIG. 49: Same specimen as Fig. 48, interior of LV. FIGS. 50–52: *A.* (*M.*) *pallida* Dunker, 1872; FIG. 50: Dunker's (1872: pl. 15, fig. 4) original illustration; FIG. 51: Syntype, exterior of RV (ZMB 112.821, 74.0 mm); FIG. 52: Same specimen as Fig. 51, interior of LV. FIGS. 53–55: *A. plicatula* Dunker, 1852; FIG. 53: Dunker's (1879: pl. 19, fig. 4) original illustration; FIG. 54: Holotype, exterior of RV (LMD/LÖB 124294a, 26.2 mm); FIG. 55: Same specimen as Fig. 54, interior of LV.

ZMB 108.684a specimen derives from the Löbbecke collection, and the ZMB 108.684b specimen—from the Lischke collection.

Label 1: "*Avicula Martensi* / Dkr / Japan. / Lischke. / Jap. Meeresconch. T p. 161 III, 112" [handwritten in brown ink by Dunker; words "*martensi*," "Drk," and line 5 in black ink added by Martens at a later date];

Label 2: "*Avicula* / *Martensi* Dkr / Japan / Löbbecke. / *Japonica* Dunk Avic 23, 3 !" [lines 1, 3, and 4 handwritten in brown ink by Dunker; lines 2 and 5 in black added by Martens at a later date].

The disarticulated shell from ZMB 108.683 perfectly matches the description and the illustration of RV by Dunker (1882: pl. 10, fig. 8) in size, shape, color and several unique features: (1) uniquely rounded (as opposed to typical triangulate) outline of the anterior auricle; (2) the number, pattern, and relative width of radial dark colored rays; and (3) the irregular damaged outline of the ventral margin. Four labels accompany ZMB 108.683:

Label 1: "Coll. Dunker" [printed];

Label 2: "*Avicula Martensii* / Dkr ⁜ / Japan / Dunk. ind moll / Jap Taf 10 Fig 8 ! /Dunker ind Moll./ Jap Tf 10 fig 8! / Original." [handwritten by Dunker; lines 4, 5, and the "⁜" symbol in line 2 added by Martens at a later date];

Label 3: "Original" [handwritten by Dunker];

Label 4: "Japan" [handwritten by Dunker].

Avicula nigrofusca Dunker, 1872 (Fig. 75)

Dunker, 1872: 20, pl. 5, fig. 4.

Type locality: Unknown.

Type material: Not located.

Comments: According to Dunker (1872: 20), *A. nigrofusca* possibly represents a young individual of *Avicula atlantica* Lamarck, 1819.

Avicula (*Meleagrina*) *olivacea* Dunker, 1872 (Figs. 47–49)

Dunker, 1872: 17, pl. 4, fig. 5.

Type locality: "Antillarum mare, mercatore teste qui concham venalem habuit" (Dunker, 1872: 17).

Syntype: ZMB 101.672, one pair of disarticulated valves; dimensions (RV): hinge length 52.1 mm, height 46.0 mm, length 55.8 mm.

Comments: The original description does not contain an explicit statement that the species was based on a single specimen. The shell from ZMB 101.672 collection perfectly matches the original description and the illustration in size, shape, and color. A distinctive semicircular notch at the anterior margin of the anterior auricle in RV and the pattern of well-preserved scales at the posterior margin unambiguously establish the identity of the shell. The shell is depicted articulated. Two labels accompany the ZMB lot:

Label 1: "coll. Dunker" [printed];

Label 2: "*olivacea* / Dunk ⁜ / Antillen / Dunk Avic. / Taf 4. Fig 5!" [lines 1 and 3 handwritten in pencil by Dunker; lines 2, 4, 5 in ink added by Martens at a later date].

Avicula (*Meleagrina*) *pallida* Dunker, 1872 (Figs. 50–52)

Dunker, 1872: 46, 47, pl. 15, fig. 4.

Type locality: Unknown.

Syntype: ZMB 112.821, one pair of disarticulated valves; dimensions (RV): hinge length 54.1 mm, height 82.0 mm, length 74.0 mm.

Comments: The original description does not contain an explicit statement that the species was based on a single specimen. It is significant that Dunker did not refer to *Avicula pallida* Conrad, 1837: 246, a senior primary homonym of *A.* (*M.*) *pallida* Dunker, 1872, whereas elsewhere he cited *Avicula nebulosa* Conrad, 1837: 246, another species from the same publication (and even from the same page). Evidently, Dunker was not familiar with Conrad's publication and relied on Reeve's (1857) interpretation of Conrad's species. Reeve (1857) omitted *A. pallida* in his revision and, consequently, so did Dunker. Dunker's *A.* (*M.*) *pallida* Dunker, 1872, a junior primary homonym of *Avicula pallida* Conrad, 1837, had not been renamed by later authors.

The shell from the ZMB collection perfectly matches the original description and the illustration in size, shape, color and several unique features: (1) conspicuous purple spots just posterior to umbo and in the middle of the exterior surface in RV; (2) short radial yellow streaks radiating from the umbo; and (3) the presence of scales only in posteroventral and anteroventral regions of RV. The shell is depicted articulated. The dimensions provided for the figured shell by Dunker (1872: 47; "quod exstat maximum a rostro usque ad alam extremam 92 m. m. longum") exceeds those obtained in the present study, most likely due to the damage along shell margins. Two labels accompany the lot:

Label 1: "*Avicula pallida* Dkr ⁜ / Dunk. Avic. Taf 15 fig 4! / - ?" [handwritten by Martens];

Label 2: "⁜ / pallida / Dkr." [handwritten by Martens].

Avicula peasei Dunker, 1872 (Figs. 92–94)

Avicula radiata Pease, 1862: 244.
Dunker, 1872: 24, 25, pl. 8, fig. 1.
Type locality: "*Hab*. Kingsmill Islands" (Pease, 1862: 244).
Syntypes (of *A. radiata* Pease, 1862, a replaced name): ZMB 112.902, five individual LV (posterior margins of two specimen damaged): hinge length 31.0–82.4 mm, height 19.9–48.7 mm, length 23.1–66.1 mm; one pair of disarticulated vales (RV): hinge length 45.5 mm, height 14.3 mm, length 17.3 mm; ZMB 20206, one LV (posterior auricle damaged): hinge length 41.7 mm, height 22.9 mm, length 25.2 mm.
Comments: Avicula peasei is a substitute name for *A. radiata* Pease, 1862, a junior primary homonym of *A. radiata* Leach, 1814. No shells unambiguously matching the specimen depicted by Dunker was found in the ZMB collection. The original description by Pease (1862) was not illustrated. Pease's type specimen (MCZ 298466) is similar to the shell illustrated by Dunker, but is articulated, unlike the figured specimen. Therefore, the source of Dunker's figure is unknown. Two ZMB lots contain specimens from the type locality sent to Dunker by Pease (Dunker, 1872: 24, "Plura specimina clar. Harper Pease benevole mecum communicavit"). Presumably, these specimens constituted part of the original type series of *Avicula radiata* Pease, 1862. (Pease's original description was not explicit with regard to the number of specimens upon which the species was based.) Two labels accompany ZMB 112.902:

Label 1: "Avicula radiata / (Pse) / Kingsmill Isles. / I have only rec^{d}. half / valves & these I send / you are the best [handwritten in ink by Pease] / 112.902" [handwritten in pencil by Köhler];

Label 2: "passt nicht zur ["does not match to"; here translated] / Abbildung 8,1 [handwritten in ink by Martens] / 112.902 [handwritten in pencil by Köhler]."

One label accompanies ZMB 20206:

Label: "Avicula Peasei / radiata Pease / Kingsmill /Pease / [unreadable] / 20206." [handwritten by Martens].

Avicula (*Meleagrina*) *petersii* Dunker, 1852 (Figs. 68, 69)

Dunker, 1852: 77, 78; 1880: 79.
Type locality: "Querimba. Attulit cl. Peters" (Dunker, 1852: 78).
Syntypes: ZMB 16.385a, one pair of disarticulated valves, posteroventral margin of RV slightly damaged; dimensions (RV): hinge length 42.9 mm, height 62.0 mm, length 68.5 mm; ZMB 16.385b, one pair of disarticulated valves, anterior margin of RV damaged and has a crack extending to the center of the valve; dimensions (RV): hinge length 42.9 mm, height 35.2 mm, length 36.5 mm RV; ZMB 975, soft tissues of two specimens in ethanol (corresponding to the dry shells from the ZMB 16.385a,b) and one juvenile pair of disarticulated valves.
Comments: Dunker indicated that the specimens upon which the description was based were collected by Peters and deposited at the ZMB collection (Dunker, 1852: 78). Peters conducted extensive collecting in Mozambique (Tete, Querimba, etc.) and much of his material is presently housed at ZMB. Dunker (1880: 79) stated that *A.* (*M.*) *petersii* is a variety of *A.* (*M.*) *lichtensteinii* Dunker, 1852. Unfortunately, he did not illustrate his specimens. The range of sizes provided by Dunker (1852: 78) implies that the species was based on multiple specimens. ZMB 16.385, catalogued by Martens as "*A. petersii*" in 1868, contains two shells collected by Peters from the type locality. The specimens from ZMB 16.385 and ZMB 975 (containing the corresponding soft tissues) are considered here as syntypes. Four labels accompany ZMB 16.385:

Label 1 (recto): "Meleagrina / Petersii/ Dkr. ⁜ / Z. Mal 1852 p. 77 / occa Rv 24 / Thier in Weingeist ["animal in alcohol"; here translated; referring to lot ZMB 975] / Querimba. / Peters / 16.385" [lines 1–3, 6–8 handwritten probably by Troschel, lines 4, 5 handwritten by Martens];

Label 1 (verso): "~~Avicula~~ / ~~brevicauda~~, / ~~Desh~~. / ~~Their in Weingeist~~. / ~~Querimba~~. / ~~Peters~~." [old typical museum label, handwritten in ink, probably by Troschel; crossing-out in pencil by unidentified person];

Label 2: "Petersi Dkr ⁜ / Mal. Zeitschr 1852. / flabellum / Rv." [handwritten by Martens];

Label 3: "bicolor / Dkr / ob die Phazies dazu gehört? / sie ähnelt der / maxima ["bicolor / Dkr / if this facies belongs to it? / it is similar to / maxima"; here translated]" [handwritten by Martens];

Label 4: "Zoologisches Museum Berlin. [printed] / Avicula 16385 / ⁜ petersi Dkr. / Querimba Ins. Peters" [lines 2, 3 handwritten by Köhler, line 4 handwritten by unidentified person; standard ZMB label].

One label accompanies ZMB 975:

Label: "Avicula / pertersi Dunker / 975 / Querimba Ins. Peters" [handwritten by Martens].

Avicula plicatula Dunker, 1852 (Figs. 53–55)

Dunker, 1852: 75, 76; 1872: 56; 1879: 57, pl. 19, fig. 4.

Type locality: Unknown.

Holotype (fixed by monotypy): LMD/LÖB 124294a, one pair of disarticulated valves (extremities of posterior auricles of both valves broken off); dimensions (RV): hinge length 31.5 mm, height 20.2 mm, length 26.2 mm.

Comments: The revised description stated that the species was based on a single specimen from the Scheepmaker collection ("Specimen hic depictum originale ad collectionem calr. Scheepmaker…") that later became incorporated into the Löbbecke collection (Dunker, 1872: 56). This is confirmed by the words "Original" and "Unicum" on the labels written by Dunker and Löbbecke. The shell from the LMD collection perfectly matches the original description and the illustration of the articulated shell in shape, size, and color, and two particular features: the jagged outlines of the ventral margin of the posterior auricle and the anterior margin, and the pattern of the abrasion in the umbonal region in RV. Four labels accompany the LMD lot:

Label 1: "Scheepm. 1121 / Avicula / plicatula Dunker / Original / Unicum / Dunker Mart. Chem. / Tab. 19 f. 4" [handwritten by Löbbecke];

Label 2: "plicatula Dkr. / unicum." [handwritten by Dunker];

Label 3: "Avicula plicatula Dkr. / Unicum / Scheepm / 1 [handwriting unidentified] Löbbecke-Museum" [old printed label of the Löbbecke Museum, c. 1910];

Label 4: "Avicula plicatula DUNKER / 1 Ex. / Unicum / Scheepmaker / Vorlagez. d. Abb. i. M. u. Ch. / Bd.VII, 3, Tafel 19, Figur 4. [typed] / Löbbecke-Museum" [printed].

Avicula (*Meleagrina*) *prasina* Dunker, 1872 (Figs. 56–58)

Dunker, 1872: 53, pl. 18, fig. 4.

Type locality: Unknown.

Syntype: ZMB 112.808, one pair of disarticulated valves; dimensions (RV): hinge length 31.2 mm, height 37.1 mm, length 35.5 mm.

Comments: The original description does not contain an explicit statement that the species was based on a single specimen. The dimensions provided for the figured shell ("Testa a cauda extrema usque ad alae anticam partem 46 m. m. longa"; Dunker, 1872: 53) only slightly exceed those obtained in the present study. This discrepancy is most likely due to the slight damage the shell margins and the tip of the posterior auricle. The shell from the ZMB collection perfectly matches the original description and the illustration in shape, unusually dark green color, and the following particular features: (1) several commarginal light green stripes in the umbonal area; (2) the presence of flat, short, wide scales on most of RV surface; and (3) and the lighter colored (yellow-brown) anterior auricle in RV. Three labels accompany the ZMB lot:

Label 1: "coll. Dunker" [printed label; glued to inner surface of LV];

Label 2: "N. Austr. / *flexuosa* Rv" [handwriting unidentified];

Label 3: "Zoolog. Museum Berlin" [printed].

Avicula (*Meleagrina*) *reentsii* Dunker, 1872 (Fig. 76)

Dunker, 1872: 9, 10, pl. 2, figs. 1, 2.

Type locality: "Habitat in Mari rubro" (Dunker, 1872: 10).

Type material: Not located.

Comments: The depicted shell originates from the Reents collection in Hamburg (Dunker, 1872: 10).

Avicula (*Meleagrina*) *reeveana* Dunker, 1872

Avicula fimbriata Reeve, 1857: Species 25, pl. 9, fig. 25.

Type locality: "North-west coast of Australia (under pieces of coral at low water)" (Reeve, 1857).

Comments: A. reeveana is a substitute name for *A. fimbriata* Reeve, 1857, a junior primary homonym of *Avicula* (*Meleagrina*) *fimbriata* Dunker, 1852. The illustration was based on the specimen from the Cuming collection figured by Reeve (1857: pl. 9, fig. 25).

Avicula rufa Dunker, 1848 (Figs. 95–97)

Dunker, 1848: 180; 1879: 58, pl. 19, figs. 7, 8.

Type locality: "Insula Java" (Dunker, 1848: 180).

Syntype: ZMB 112.966, one pair of disarticulated valves; dimensions (RV): hinge length 66.4 mm, height 36.4 mm, length 39.3 mm.

Probable *syntypes:* ZMB 16.353, two pairs of disarticulated valves; dimensions (RV): hinge length 53.5 mm, height 19.1 mm, length 28.0

mm; hinge length 42.6 mm, height 11.4 mm, length 18.2 mm (posterior auricle damaged).

Comments: The types were stated to originate from Java and were communicated to Dunker by Philippi (Dunker, 1848: 180). This suggests that some of the specimens upon which the species was based might be in the Philippi collection, possibly still extant at MNHS. None of the specimens at ZMB perfectly match the shells depicted by Dunker (1879: pl. 19, figs. 7, 8). ZMB 112.966 contains a shell from the Dunker collection that is very similar to the figured specimens. This specimen was obtained by Winter from Java and was most likely part of the original type series and is here considered a syntype.

Four labels accompany ZMB 112.966:

Label 1: "*Avicula rufa*, / Dkr. / Java. / Winter." [handwritten by Dunker; original label of the Dunker collection];

Label 2: "*Avicula*. / Flores. K." [handwritten by Dunker; original label of the Dunker collection];

Label 3: "coll. Dunker" [printed; glued to verso of Label 1];

Label 4: "Zoologisches Museum Berlin. [printed] / Java Dunker" [handwriting unidentified; standard ZMB label].

The two shells in ZMB 16.353 were cataloged as types of *A. rufa* in 1868 (catalog entry handwritten by Martens). These shells are similar but not identical to either of the two articulated shells illustrated by Dunker (1879: pl. 19, figs. 7, 8). The larger shell of the two pairs of disarticulated valves lot is similar to the depicted shells in overall shape and color but is different in (1) the extent of the posterior auricle; (2) the shape of the anterior auricles as observed in RV; (3) the abraded outer shell layer at the umbo; and (4) some marginal fractures. (The damage, however, could have occurred subsequently to the illustration.)

One label accompanies ZMB 16.353:

Label: "*Avicula* / *rufa*, / Dunker / Mke et Pfr. Zeitschr. f. / Malacoz. 1848 p. 180 / cf inquinata Rv / 16353" [handwriting unidentified; lines 6 and 7 handwritten by Martens; standard ZMB label].

Avicula (*Meleagrina*) *scheepmakeri* Dunker, 1872 (Figs. 59–61)

Dunker, 1872: 6, pl. 1, fig. 1.

Holotype (fixed by monotypy): ZMB 112.911, one pair of disarticulated valves; dimensions: hinge length 54.6 mm, height 87.3 mm, length 93.6 mm.

Type locality: Unknown.

Comments: Dunker's mention of the single original specimen upon which the species was based ("Das Original"; Dunker, 1872: 6) and the presence of Dunker's labels marked as "Original" warrant the recognition of the specimen from the ZMB collection as a holotype by monotypy. The shell derived from the Scheepmaker collection (Dunker, 1872: 6) that later became incorporated into the collection of Wilhelm Arnold in Nordhausen (Dunker, 1880: 79), which is also currently housed at ZMB. According to Dunker (1880: 79), the specimen came from Solomon Islands, as communicated by Dr. Augustus Sutor who, in turn, was informed by Dr. Krefft from Sydney. The black-and-white photographs of the holotype were published by Ranson (1961: pl. 14, fig. 2 [LV exterior], fig. 5 [RV exterior]; pl. 15, fig. 2 [LV interior], fig. 5 [RV interior]).

The specimen from ZMB 112.911 matches the original description and the illustration in size, shape, color, and several unique features: (1) the outline of the abraded outer shell layer near the umbo and close to the byssal notch in RV; (2) the outline of the damaged area of RV ventral margin; (3) the radial fracture extending from the ventral margin of RV to about one fourth of shell height; (4) the indentation on the hinge line posterior to umbones; (5) the outline of shell margin in the ventral part of LV opposing the byssal notch; and (6) the color pattern of two wide dark stripes on the inner surface of the anterior margin or LV. The shell is depicted with valves diagonally staggered. Two labels accompany the ZMB lot:

Label 1: "*Avicula scheepmakeri* / Dkr. / Mus. Scheepmaker / Original zu meiner ["My original"; here translated] / Abbildung! Dkr." [handwritten by Dunker];

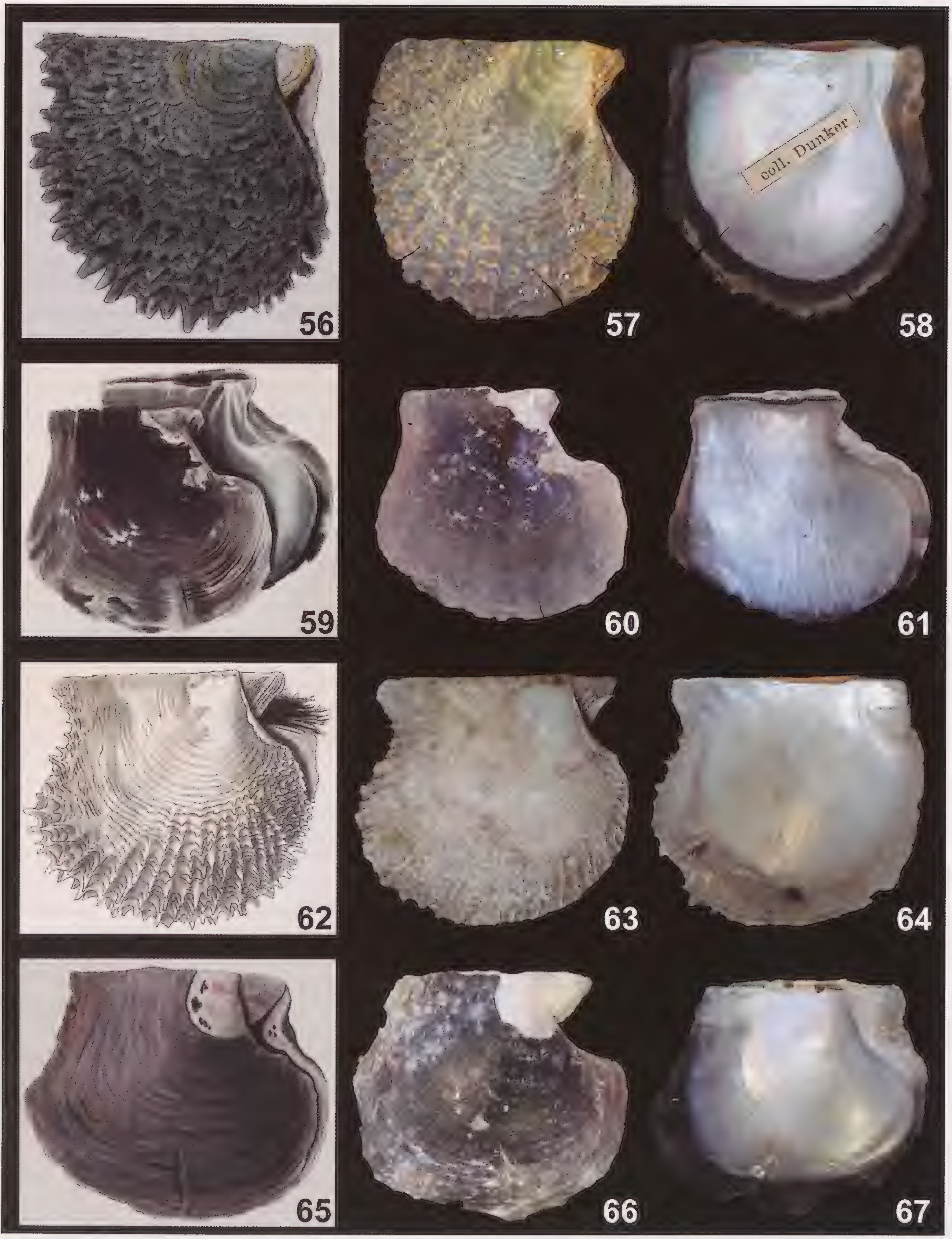
Label 2: "*Meleagrina scheepmakeri* / Dkr. / Original zu Dunkers Abbild. / M.Ch. fol.6 taf 1 fig.1" [handwriting unidentified; label of the Arnold collection].

Avicula serrulata Dunker, 1848 (Figs. 98–100)

Dunker, 1848: 178, 179; 1872: 18, 19, pl. 5, figs. 1, 2.

Type locality: "Habitat ad insulas Moluccanas" (Dunker, 1848: 179).

Syntype: ZMB 108.695, one pair of disarticulated valves; dimensions (RV): hinge length 92.5 mm, 61.2 height mm, length 81.9 mm.



FIGS. 56–67. Representative type specimens of *Avicula* from the Dunker collection. Shells arranged with hinge axis oriented horizontally. One of the syntypes is illustrated. Size is expressed as shell length. FIGS. 56–58: *A.* (*Meleagrina*) *prasina* Dunker, 1872; FIG. 56: Dunker's (1872: pl. 18, fig. 4) original illustration; FIG. 57: Syntype, exterior of RV (ZMB 112.808, 35.5 mm); FIG. 58: Same specimen as Fig. 57, interior of LV. FIGS. 59–61: *A.* (*M.*) *scheepmakeri* Dunker, 1872; FIG. 59: Dunker's (1872: pl. 1, fig. 1) original illustration; FIG. 60: Holotype, exterior of RV (ZMB 112.911, 93.6 mm); FIG. 61: Same specimen as Fig. 60, interior of LV. FIGS. 62–64: *A.* (*M.*) *tamsiana* Dunker, 1852; FIG. 62: Dunker's (1872: pl. 4, fig. 1) original illustration; FIG. 63: Syntype, exterior of RV (ZMB 101.675, 60.1 mm); FIG. 64: Same specimen as Fig. 63, interior of LV. FIGS. 65–67: *A.* (*M.*) *tristis* Dunker, 1872; FIG. 65: Dunker's (1872: pl. 14, fig. 3) original illustration; FIG. 66: Syntype, exterior of RV (ZMB 108.680, 57.0 mm); FIG. 67: Same specimen as Fig. 66, interior of LV.

Comments: The species was based on multiple specimens. The shell from the ZMB collection perfectly matches the original description and the illustration by Dunker (1872: pl. 5, fig. 1) in size, shape, color, and several unique features: (1) the protruding and distally widening anterior auricle; (2) the radial fracture extending from the midventral margin to approximately half-height of the shell; (3) the outline of the fractures at the dorsal margin; and (4) the outline of the abraded outer shell layer at the umbonal region. The specimen was communicated by Winter (Dunker, 1848: 179). The second figure (Dunker, 1872: pl. 5, fig. 2) was copied from the illustration by Reeve (1857: pl. 4, fig. 5). Reeve referred to this species as *Avicula lata* Gray, and based his illustration on a specimen from the Cuming collection from "Port Essington and Raines' Island, Torres Straits, Australia" (Reeve, 1857: Species 5). Four labels accompany the ZMB lot:

Label 1: "coll. Dunker" [printed];

Label 2: "*Avicula serru- / lata*. Dkr. / Insulae Molluc. / com. et. Winter" [handwritten by Dunker; original label of the Dunker collection];

Label 3: "*Avicula serrulata*. / Dkr. ⁜ / Monog. Tf. 5 fig 1.2 / Molukken / Winter. / Winter" [handwritten by Dunker; lines 3, 4, 6, and the "⁜" symbol in line 2 added by Martens at a later date; original label of the Dunker collection];

Label 4: "*serrulata* / Dkr ⁜" [handwritten by Martens].

Avicula spadicea Dunker, 1852 (Figs. 77, 78)

Dunker, 1852: 73; 1872: 31, pl. 10, figs. 1, 8.

Type locality: "Habitat in Mari Rubro; attulit. Cl. Rob. Rodatz" (Dunker, 1852: 73).

Type material: Not located.

Comments: According to Dunker (1852: 73; 1872: 31), the specimens upon which the original description was made came from the Rodatz collection. The location of the type material is unknown.

Avicula spadicea var. Dunker, 1879

Avicula rutila Reeve, 1857: Species 19, pl. 8, fig. 19; Dunker, 1879: 62, pl. 22, fig. 1.

Type locality: "Australia" (Reeve, 1857).

Comments: Dunker (1879: 62) considered *Avicula rutila* Reeve, 1857, to be a variety of *A. spadicea* Dunker, 1852. The illustration was based on the specimen from the Cuming collection figured by Reeve (1857: pl. 8, fig. 19).

Avicula straminea Dunker, 1852
(Figs. 101–103)

Dunker, 1852: 74, 75; 1872: 26, 27, pl. 9, fig. 1.

Type locality: Unknown.

Syntype: ZMB 112.865, one pair of articulated valves; dimensions (RV): hinge length 81.6 mm, height 36.3 mm, length 54.3 mm.

Comments: The original description does not contain an explicit statement that the species was based on a single specimen. In the subsequent revision, Dunker (1872: 26) mentioned the presence of other specimens, probable syntypes, in his collection, although it could not be established if these specimens were available to Dunker at the time of the original description. The specimens from ZMB 112.865 closely matches the original description and illustration size, shape, color, and several distinctive features: (1) the pattern of two folds on the exterior surface of the anterior auricle of RV; (2) the outlines of the slightly damaged ventral margin of RV and of the exposed anterior margin of LV; (3) the outline of the irregular fracture of the outer layer of RV; and (4) a distinct curved line (dark brown in the drawing but much lighter in the actual specimen) in the middle of the depressed area demarcating the posterior auricle from the posterior margin of RV. The damaged tip of the posterior auricle of RV and the barnacle incrustation of the umbonal region are not illustrated. The shell is depicted articulated. The specimen originates from the Gruner collection as was stated in the original description (Dunker, 1852: 74; 1872: 26), and, according to the labels, must have subsequently been incorporated into the Paetel collection. The original description does not indicate type locality ("patria ignota"), but in his revision, Dunker (1872: 26) noted that the species if found in the eastern Indian Ocean. Three labels accompany the ZMB lot:

Label 1: "coll. Paetel" [printed];

Label 2: "*Avicula* / ~~*fimbriata* Dkr.~~ / 1. Austol. / 300m" [handwritten in ink by Paetel; the second line crossed out in pencil by unidentified person; original label of the Paetel collection];

Label 3: "*straminea* / Dkr." [handwritten by Martens].

Avicula (*Meleagrina*) *tamsiana* Dunker, 1852
(Figs. 62–64)

Dunker, 1852: 78; 1872: 15, 16, pl. 4, figs. 1, 2 (var.).

Type locality: "Prope Puerto Cabello legit cl. G. Tams, Med. Dr. (La Guayra teste Koch)" (Dunker, 1852: 78).

Syntype: ZMB 101.675, one pair of disarticulated valves; dimensions (RV): hinge length 52.5 mm, height 54.5 mm, length 60.1 mm.

Comments: The original description does not contain an explicit statement that the species was based on a single specimen. The specimen from ZMB 101.675 matches the original description and the illustration in size, shape, color, and two unique features: the outward folding of the anterodorsal margin of RV close to the byssal notch, and the pattern of dark blotches on the dorsal and posterior side of the umbo. The fact that the shell is depicted articulated with the byssus extending through the byssal notch suggests that valves were separated at a later date and the byssus was lost. Dunker obtained his specimen(s) from Tams (Dunker, 1852: 78; 1872: 16). Three labels accompany the ZMB lot:

Label 1: "coll. Dunker" [printed];

Label 2: "*Avicula* (*Melea / grina*) *Tamsii, / Tamsiana* / Dkr. ⁜ / Pto Cabello / Tams / Avic. 4 fig. 1 Tam5." [handwritten by Dunker; lines 3, 6, and the "⁜" symbol in line 4 added by Martens at a later date; original label of the Dunker collection];

Label 3: "Zoologisches Museum Berlin. [printed] / Puerto Cabello Dunker" [handwriting unidentified; standard ZMB label].

Avicula tortirostris Dunker, 1848
(Figs. 104–106)

Dunker, 1848: 179, 180; 1872: 37, 38, pl. 11, fig. 6.

Type locality: "Insula Java" (Dunker, 1848: 180).

Syntype: ZMB 112.866, one pair of disarticulated valves; dimensions (RV): hinge length 84.2 mm, height 23.5 mm, length 31.6 mm.

Comments: The original description does not contain an explicit statement that the species was based on a single specimen. The shell in ZMB 112.866 closely matches the original description and illustration in shape, color, and several unique features: (1) anteriorly extending anterior auricle in RV with atypical fold; (2) the outline of the fracture proximal to the dorsal margin of RV; and (3) the outline of the broken margin immediately ventral to the byssal notch in LV. The shell is shown articulated. The fact that the dimensions provided for the figured shell by Dunker (1872: 37, 38; "Long. marginis superioris subrecti ab umbonibus usque ad extremam caudam 65 m. m., long. rostri 21, long. ab umbonibus ad finem alae 50") exceed those obtained in the present study, is most likely due to the damage along the ventral shell margins and the posterior auricle. The tip of the posterior auricle in and the posteroventral margin in RV are more severely damaged than illustrated. Four labels accompany the ZMB lot:

Label 1: "coll. Dunker" [printed];

Label 2: "*Avicula tor. / tirostris* Dkr. / Ins. Java / Mad. Schnell" [handwritten by Dunker; original label of the Dunker collection];

Label 3: "*tortirostris* Rv" [handwritten by Martens];

Label 4: "Dunker / taf 11 fig 6" [handwritten by Martens].

Avicula (*Meleagrina*) *tristis* Dunker, 1872
(Figs. 65–67)

Dunker, 1872: 44, pl. 14, fig. 3.

Type locality: Unknown.

Syntype: ZMB 108.680, one pair of disarticulated valves; dimensions (RV): hinge length 43.3 mm, height 52.5 mm, length 57.0 mm.

Comments: The original description does not contain an explicit statement that the species was based on a single specimen. The shell from the ZMB collection perfectly matches the original description and the illustration in size, shape, and color. The shell is unambiguously defined by the following features of RV: (1) the radial fracture of the outer shell layer in the midventral part of the valve; (2) the broad and rounded outline of the abraded prismatic layer in the umbonal region; and (3) the fracture originating from the dorsal part of the umbonal abraded region that extends posteriorly along the hinge line. The margins of the specimen are more strongly damaged than depicted. The shell is depicted articulated. Two labels accompany the ZMB lot:

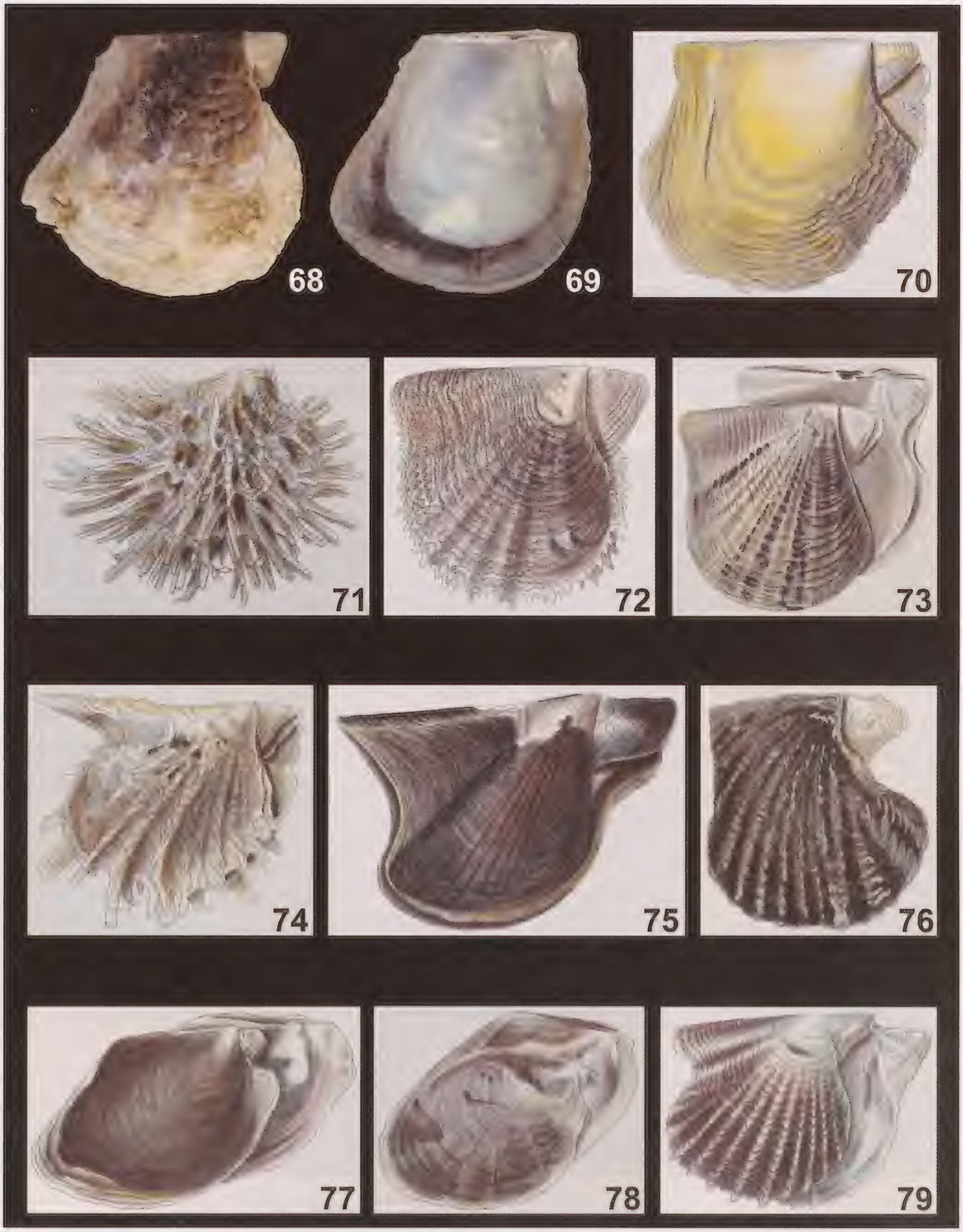
Label 1: "*Avicula nigra* / (Singapore A. Gould) Glot / =*tristris* Dkr. ⁜ / Avic. Monogr. Taf 14 / Fig 3" [handwritten by Martens];

Label 2: "*nigra* A Gould / *tristis* / ⁜ / Dkr" [handwritten by Martens].

Avicula undata Dunker, 1879
(Figs. 107–109)

Dunker, 1879: 68, pl. 24, fig. 2.

Type locality: Unknown.



FIGS. 68–79. Representative type specimens of *Avicula* from the Dunker collection. Shells arranged with hinge axis oriented horizontally. One of the syntypes is illustrated. Size is expressed as shell length. FIGS. 68, 69: *A.* (*Meleagrina*) *petersii* Dunker, 1852; FIG. 68: Syntype, exterior of RV (ZMB 16.385a, 68.5 mm); FIG. 69: Same specimen as Fig. 68, interior of LV. FIG. 70: *A.* (*M.*) *citrina* Dunker, 1852; Dunker's (1872: pl. 3, fig. 4) original illustration. FIG. 71: *A.* (*M.*) *echinus* Dunker, 1872; Dunker's (1872: pl. 13, fig. 2.) original illustration. FIGS. 72, 73: *A.* (*M.*) *fimbriata* Dunker, 1852; Dunker's (1872: pl. 3, figs. 2, 6) original illustrations. FIG. 74: *A.* (*M.*) *grisea* Dunker, 1872; Dunker's (1872: pl. 2, fig. 5) original illustration. FIG. 75: *A. nigrofusca* Dunker, 1872; Dunker's (1872: pl. 5, fig. 4) original illustration. FIG. 76: *A.* (*M.*) *reentsii* Dunker, 1872; Dunker's (1872: pl. 2, fig. 1) original illustration. FIGS. 77, 78: *A. spadicea* Dunker, 1852; Dunker's (1872: pl. 10, figs. 1, 8) original illustrations. FIG. 79: *A.* (*M.*) *varia* Dunker, 1872; Dunker's (1872: pl. 4, fig. 6) original illustration.

Syntype: ZMB 108.688, one pair of disarticulated valves; dimensions (RV): hinge length 63.2 mm, height 19.9 mm, length 27.9 mm.

Comments: The original description does not contain an explicit statement that the species was based on a single specimen. The single shell present in the type lot closely matches the original description and illustration in size, shape, color, and several unique features: (1) a radial green stripe passing through the depression separating the posterior auricle from the posterodorsal margin of RV; (2) two folds radiating from the umbo on the exterior surface of the anterior auricle of RV; and (3) somewhat lighter coloration at the anterior half of RV surface. The shell is depicted articulated. Three labels accompany the ZMB lot:

Label 1: "coll. Dunker" [printed label];

Label 2: "Taf. 24. f. 2. / *A. undata* / Dkr" [handwritten by Dunker];

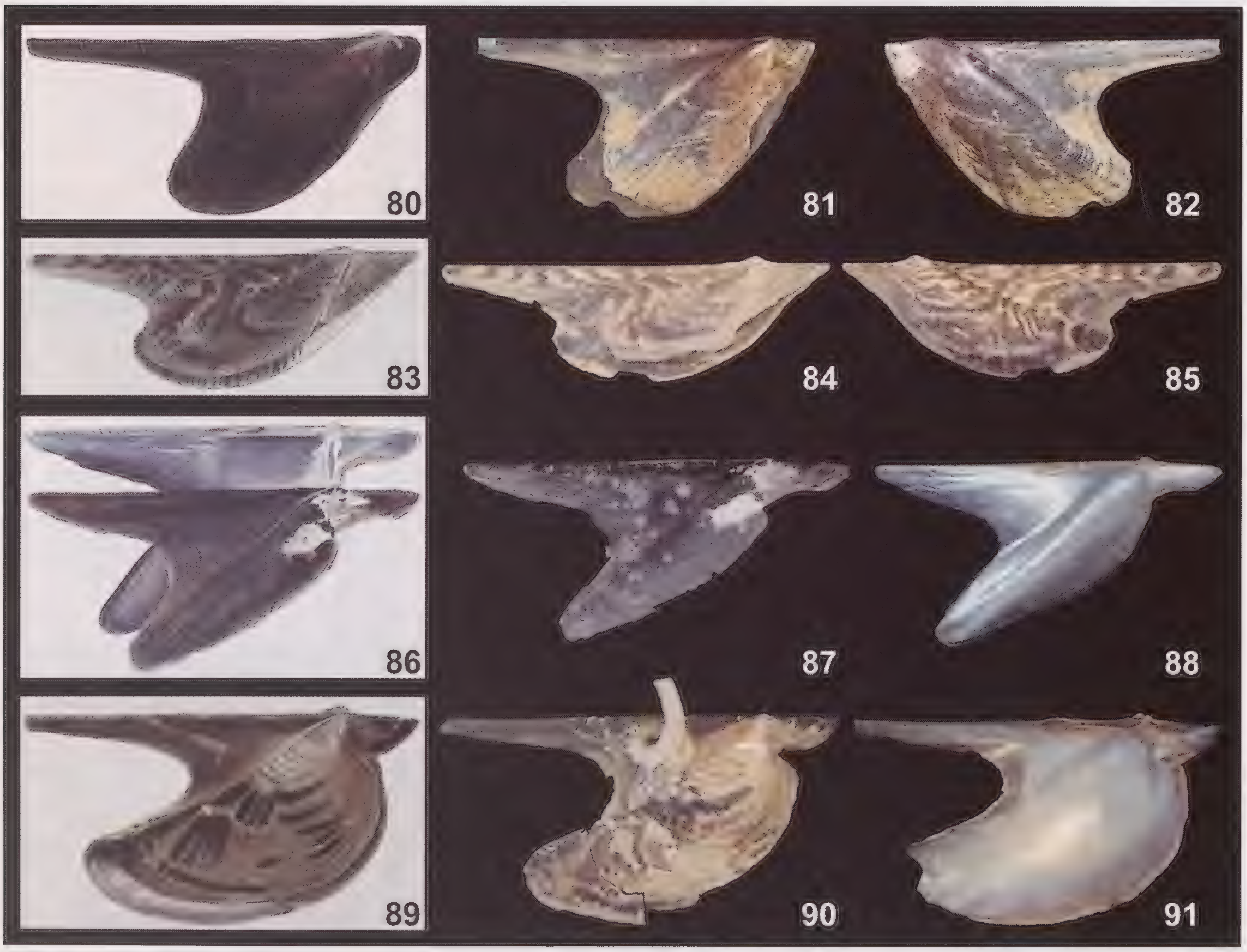
Label 3: "Landauer" [handwritten by Dunker];

Label 4: "*undata* Dkr. ⁜" [handwritten by Martens].

Avicula (*Meleagrina*) *varia* Dunker, 1872
(Fig. 79)

Dunker, 1872: 17, 18, pl. 4, fig. 6.

Type locality: "Hanc speciem colore variabilem beatus Albertus Rodatz e Mari rubo quondam attulit" (Dunker, 1872: 18).



FIGS. 80–91. Representative type specimens of *Avicula* from the Dunker collection. Shells arranged with hinge axis oriented horizontally. One of the syntypes is illustrated. Size is expressed as shell length. FIGS. 80–82: *A. atrata* Dunker, 1872; FIG. 80: Dunker's (1879, pl. 19, fig. 1) original illustration; FIG. 81: Probable syntype, exterior of RV (ZMB 114.467a, 48.7 mm); FIG. 82: Same specimen as Fig. 81, exterior of RV. FIGS. 83–85: *A. coturnix* Dunker, 1879; FIG. 83: Dunker's (1879: pl. 23, fig. 5) original illustration; FIG. 84: Syntype, exterior of RV (ZMB 108.689a, 22.2 mm); FIG. 85: Same specimen as Fig. 84, exterior of LV. FIGS. 86–88: *A. cypsellus* Dunker, 1872; FIG. 86: Dunker's (1872: pl. 8, fig. 4) original illustration; FIG. 87: Syntype, exterior of RV (LMD/LÖB 132969a, 51.7 mm); FIG. 88: Same specimen as Fig. 87, interior of LV. FIGS. 89–91: *A. jeffreysii* Dunker, 1880; FIG. 89: Dunker's (1879: pl. 24, fig. 3) original illustration; FIG. 90: Syntype, exterior of RV (ZMB 108.691, 39.5 mm); FIG. 91: Same specimen as Fig. 90, interior of LV.

Type material: Not located.

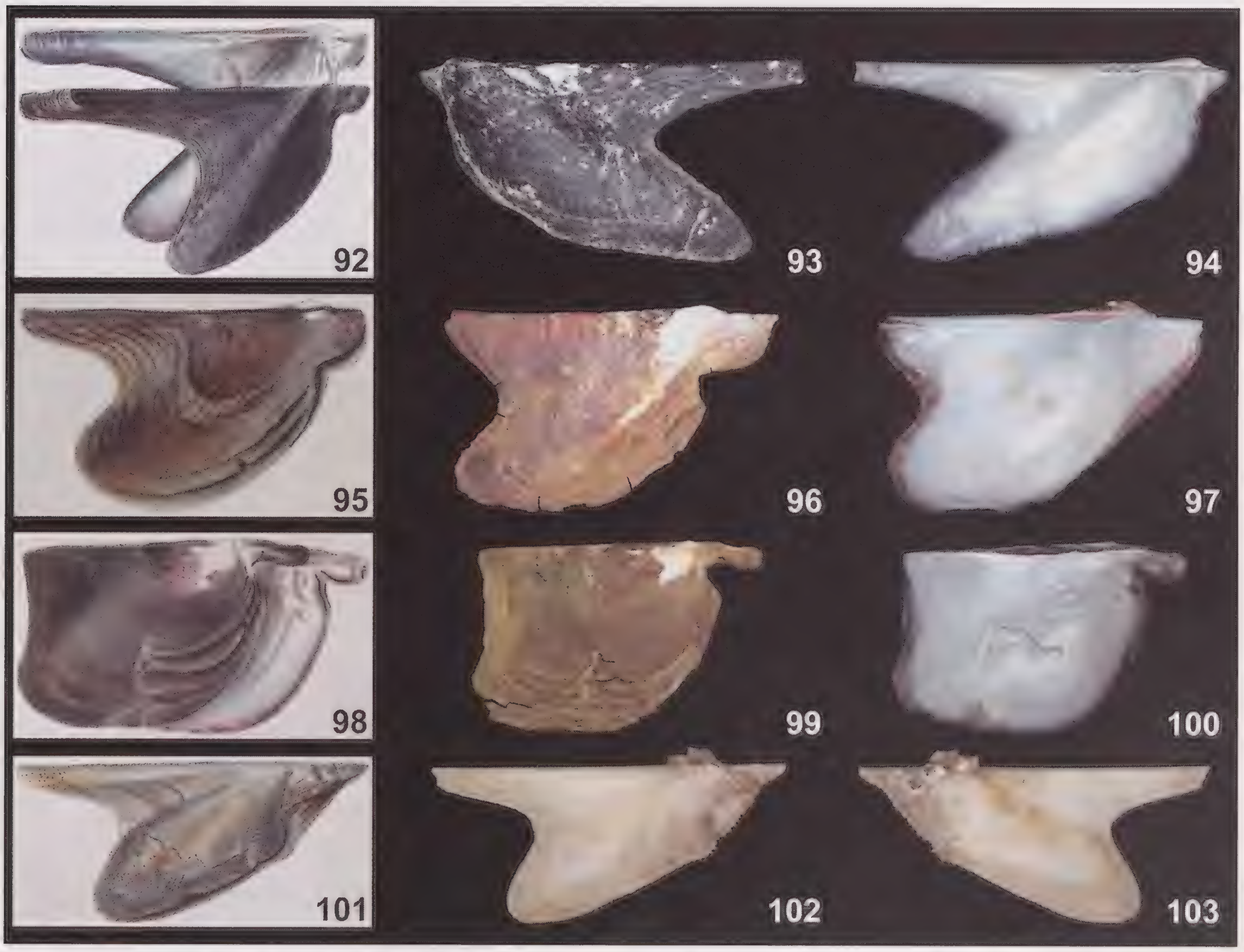
Comments: No shell from the Dunker collection at ZMB matches a rather unspecific figure of a disarticulated shell (LV shifted to right). The original description refers to Rodatz, who might have owned the specimen upon which the species was based. Martens identified ZMB 112.965 from the Dunker collection as *A.* cf. *varia* from the Red Sea. None of the specimens (three pairs of disarticulated valves and two single right valves), however, unquestionably match the illustration, and no original labels are preserved. Five labels accompany the ZMB lot:

Label 1: "cf A varia / Dunk Tf 4 Fig 6 / (Rothes Meer)" [handwritten by Martens];
Label 2: "coll. Dunker" [printed label, glued to verso of Label 1];
Label 3: "varia Dkr" [handwritten by Martens];
Label 4: "varia Dkr" [handwritten by Martens];
Label 5: "Zoologisches Museum Berlin. [printed] / Rotes Meer Dunker" [handwriting unidentified; standard ZMB label].

Avicula venezuelensis Dunker, 1872
(Fig. 115)

Dunker, 1872: 19, pl. 5, fig. 3.

Type locality: "Litus Venezuelense" (Dunker, 1872: 19).



FIGS. 92–103. Representative type specimens of *Avicula* from the Dunker collection. Shells arranged with hinge axis oriented horizontally. One of the syntypes is illustrated. Size is expressed as shell length. FIGS. 92–94: *Avicula peasei* Dunker, 1872; FIG. 92: Dunker's (1872: pl. 8, fig. 1) original illustration; FIG. 93: Syntype, exterior of LV (ZMB 112.902, 64.0 mm); FIG. 94: Same specimen as Fig. 93, interior of LV. FIGS. 95–97: *A. rufa* Dunker, 1848; FIG. 95: Dunker's (1879: pl. 19, fig. 8) original illustration; FIG. 96: Probable syntype, exterior of RV (ZMB 112.966, 39.3 mm); FIG. 97: Same specimen as Fig. 96, interior of LV. FIGS. 98–100: *A. serrulata* Dunker, 1848; FIG. 98: Dunker's (1872: pl. 5, fig. 1) original illustration; FIG. 99: Syntype, exterior of RV (ZMB 108.695, 81.9 mm); FIG. 100: Same specimen as Fig. 99, interior of LV. FIGS. 101–103: *A. straminea* Dunker, 1852; FIG. 101: Dunker's (1872: pl. 9, fig. 1) original illustration; FIG. 102: Syntype, exterior of RV (ZMB 112.865, 54.3 mm); FIG. 103: Same specimen as Fig. 102, exterior of LV.

Type material: Not located.

Comments: There is no information on the type material.

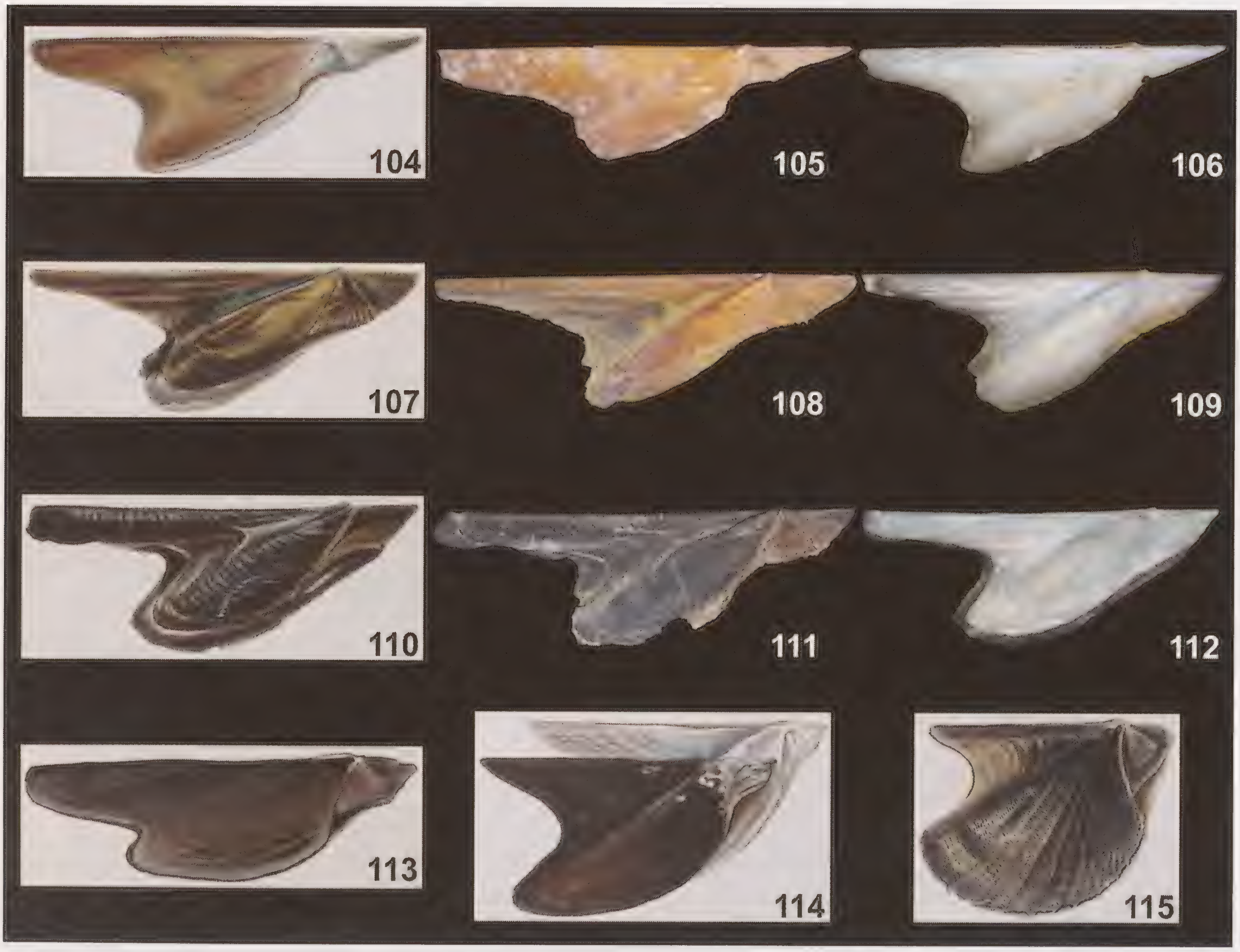
Avicula versicolor Dunker, 1879
(Figs. 110–112)

Dunker, 1879: 68, pl. 24, figs. 1, 4.

Type locality: Unknown.

Syntypes: ZMB 108.686, one pair of articulated valves; dimensions (both valves): hinge length 55.5 mm, height 21.1 mm, length 30.9 mm; ZMB 108.687, one pair of disarticulated valves; dimensions (RV): hinge length 62.5 mm, height 19.4 mm, length 28.5 mm.

Comments: The species was based on multiple specimens. Both specimens, most likely conspecific, closely match the original description and illustrations in size, shape, and several unique features. The syntype ZMB 108.686 is similar to the shell depicted in Dunker's fig. 1 (Dunker, 1879: pl. 24) in (1) the outline of extensively damaged shell margin in both valves and the tips of the posterior auricles; (2) the pattern of commarginal stripes in the posterodorsal region and the auricular sinus of RV; and (3) the general pattern of coloration (while the dark brown-greenish part of RV surface in the illustration does not perfectly match the bright green color in the



FIGS. 104–115. Representative type specimens of *Avicula* from the Dunker collection. Shells arranged with hinge axis oriented horizontally. One of the syntypes is illustrated. Size is expressed as shell length. FIGS. 104–106: *A. tortirostris* Dunker, 1848; FIG. 104: Dunker's (1872: pl. 11, fig. 6) original illustration; FIG. 105: Syntype, exterior of RV (ZMB 112.866, 31.6 mm); FIG. 106: Same specimen as Fig. 105, interior of LV. FIGS. 107–109: *A. undata* Dunker, 1879; FIG. 107: Dunker's (1879: pl. 24, fig. 2) original illustration; FIG. 108: Syntype, exterior of RV (ZMB 108.688, 27.9 mm); FIG. 109: Same specimen as Fig. 108, interior of LV. FIGS. 110–112: *A. versicolor* Dunker, 1879; FIG. 110: Dunker's (1879: pl. 24, fig. 4) original illustration; FIG. 111: Syntype, exterior of RV (ZMB 108.687, 28.5 mm); FIG. 112: Same specimen as Fig. 111, interior of LV; FIG. 113: *A. brevialata* Dunker, 1872; Dunker's (1879: pl. 19, fig. 3) original illustration. FIG. 114: *A. gruneri* Dunker, 1872; Dunker's (1872: pl. 18, fig. 1) original illustration; FIG. 115: *A. venezuelensis* Dunker, 1872; Dunker's (1872: pl. 5, fig. 3) original illustration.

actual specimen). The shell is depicted articulated. The other specimen, ZMB 108.687, corresponds to the second figure accompanying the original description (Dunker, 1879: pl. 24, fig. 4) in having (1) the outline of the damage ventral edge of the posterior auricle in RV; (2) the presence of two pale stripes in the depressed area separating the posterior auricle from the posterodorsal margin of RV; and (3) a single, whitish, short stripe running perpendicular to shell margin of RV. This shell is more severely damaged along margins than depicted. Although the specimen is shown articulated, the valves are presently separated. Two labels accompany ZMB 108.687:

Label 1: "coll. Dunker" [printed label];
Label 2: "Taf. 24. f. 4. / *A. versicolor* / Dkr" [handwritten by Dunker].

Three labels accompany ZMB 108.686:
Label 1: "coll. Dunker" [printed label];
Label 2: "*versicolor* / Dkr ⁜" [handwritten by Martens];
Label 3: "Taf. 24. / fig. 1. / *A. versicolor* Dkr" [handwritten by Dunker].

FIGURED NON-TYPE MATERIAL FROM THE DUNKER COLLECTION

Avicula crocea Lamarck, 1819

Lamarck, 1819: 148, no. 6; Dunker, 1872: 35, 36, pl. 11, figs. 1–4.

Type locality: "Habite les mers de l'Isle de France pour ler coquilles [a et b]. Mus. n°. La variété [c] ne m'est pas connue" (Lamarck, 1819: 148).

Figured specimen: LMD/LÖB 132968a, one pair of disarticulated valves; dimensions (RV): hinge length 62.5 mm, height 29.7 mm, length 59.5 mm.

Comments: The specimen from LMD/LÖB 132968a closely corresponds to figs. 1 and 2 by Dunker (1872: pl. 11; fig. 1 showing the exterior of RV superimposed over the interior of LV; fig. 2 showing the exterior of LV). The specimen perfectly matches the illustrations in overall shape, size, color, and in a unique pattern of radial dark chestnut rays in both valves and the pattern of the abraded dorsal part of RV. No historical labels are preserved. Dunker's fig. 3 is based on a specimen from the Cuming collection from Island of Mindoro, Philippine Islands, previously illustrated by Reeve (1857: pl. 15, fig. 57). The source of fig. 4 is not determined.

Avicula (*Meleagrina*) *flabellum* Reeve, 1857

Avicula flabellum Reeve, 1857: Species 7, pl. 5, figs. 7, 8, pl. 7, fig. 16; Dunker, 1872: 20, 21, pl. 6, fig. 1.

Type locality: "Venezuela" (Reeve, 1857).

Figured specimen: ZMB 112.822, one pair of disarticulated valves; dimensions (RV): hinge length 32.7 mm, height 45.0 mm, length 42.3 mm.

Comments: Avicula flabellum was based on the Venezuelan specimens from the Cuming collection (Reeve, 1857: species 7). To illustrate Reeve's species, Dunker used a shell from Porto Cabello, Venezuela, that was communicated by Tams (Dunker, 1872: 21). ZMB 112.822 contains a disarticulated shell with the enclosed byssus from the Dunker collection that perfectly matches an articulated shell illustrated by Dunker (1872: pl. 6, fig. 1) in overall shape, size, and color, and several unique features: (1) multiple small epibionts (that appear as small white dots in the figure) cemented proximal to the umbo; (2) the presence of the byssus; and (3) the long pale brown and dark brown scales of the exterior surface. Three labels accompany the ZMB lot:

Label 1: "flabellu / Reeve / Porto Cabello / Tams / Dk 6.1 / nicht genau ["not exactly"; here translated; lines 1–4 handwritten in pencil by Dunker; lines 5 and 6 handwritten in ink by Martens];
Label 2: "coll. Dunker" [printed];
Label 3: "Zoologisches Museum Berlin. [printed] / Porto Cabello Dunker" [handwriting unidentified; typical ZMB label].

Avicula heteroptera Lamarck, 1819

Lamarck, 1819: 148, no. 4; Dunker, 1879: pl. 24, fig. 8; 1880: 70, 71.

Type locality: Unknown.

Figured specimen: ZMB 112.863, single LV, posterior extremity of posterior auricle damaged; dimensions (LV): hinge length 45.3 mm, height 17.3 mm, length 25.0 mm.

Comments: The specimen from ZMB 112.863, a single LV, perfectly matches the illustration by Dunker, by the overall shape, size, and color pattern, and, more specifically, by a notch-like damage of the ventral border of the anterior auricle and the outline of the white encrusted area at the umbonal region. Two labels accompany the ZMB lot:

Label 1: "Tab. 24 f. 8 / T. 24" [handwritten by Dunker];

Label 2: "heteroptera. [handwritten in pencil by Dunker] / Delessert recueil 14, 7 / Dunk monogr Tf 24 fig 8!" [handwritten in ink by Martens].

Avicula iridescens Reeve, 1857

Reeve, 1857: Species 48, pl. 13, fig. 48; Dunker, 1872: 37, pl. 11, fig. 5.

Type locality: "Moluccas" (Reeve, 1857).

Figured specimen: LMD/LÖB 124268a, one pair of disarticulated valves, extremities of posterior auricles of both valves broken off; dimensions (RV): hinge length 72.4 mm, height 41.0 mm, length 57.6 mm.

Comments: The specimen upon which the species was based derives from the Cuming collection (Reeve, 1857: Species 48). Dunker (1872: 37) stated that, according to Cuming and Gruner, the species is native to the Moluccas. The lot from LMD/LÖB 124268a contains a specimen from the Gruner collection that perfectly matches the figured shell in overall shape, size, and several unique features: (1) the white incrustation of the exterior surface of the auricle of RV; (2) a notch on the ventral margin of RV; and (3) a yellow arc-shaped stripe on the interior nacreous surface of the posterior auricle of LV. Five labels accompany the LMD lot:

Label 1: "Gruner 1328 b / Avicula / crocea var. Lam. / Ostindien" [handwriting unidentified];

Label 2: "Gruner 1328 b / Avicula / crocea variet. ? ? / Ostindien / (nach Dunker sehr zweifelhaft) ["(very dubious according to Dunker)"; here translated]" [handwriting unidentified];

Label 3: "Avicula / crocea / var. b. Lamk" [handwritten by Dunker];

Label 4: "Diese Art / ist mir noch zwei / felhaft ["This variety / still appears dubious to me"; here translated]" [handwritten by Dunker];

Label 5: "Avicula / crocea Lam. Var. / Ost Indien / Gruner / 1 [handwriting unidentified] Löbbecke-Museum [printed]";

Label 5: "1328" [printed; affixed to posterior auricle of LV].

Avicula (*Meleagrina*) *margaritifera* (Linnaeus, 1758)

Mytilus margaritiferus Linnaeus, 1758: 704, no. 209 [the Indian Ocean]; Dunker, 1872: 4, 7–9, 13, 27, pl. 1, fig. 2, pl. 3, fig. 1 [juv.], pl. 9, figs. 2, 3; 1879: 58, 59, pl. 20, figs. 1, 2 [var.]; 1880: 75, 78, pl. 26, fig. 1. Note: Dunker (1872: 7) erroneously refers to Figures 1 and 2 on Plate 9 (instead of Figures 2 and 3 respectively).

Type locality: "Habitat in utriusque Indiæ oceano" (Linnaeus, 1758: 704).

Figured specimens: ZMB 112.799a, one pair of articulated valves; dimensions (RV): hinge length 27.0 mm, height 27.7 mm, length 30.0 mm; ZMB 108.682, one pair of disarticulated valves, anteroventral margins of both valves damaged; dimensions (RV): hinge length 33.9 mm, height 54.3 mm, length 45.2 mm; ZMB 112.813, single RV; dimensions (RV): hinge length 82.5 mm, height 88.3 mm, length 89.2 mm.

Comments: The sources of Figure 2 (Plate 1), Figure 1 (Plate 3), and Figure 2 (Plate 20) were not determined. Figure 1 on Plate 26 is reproduced from Chemnitz (1785: pl. 80, fig. 718).

The specimen illustrated by Dunker (1872) on Plate 9, Figure 2, perfectly matches one of the two conspecific specimens from a lot from the Dunker collection, ZMB 112.799, in shape, color, and size, and a several unique features: (1) the number and unique pattern of green radial rays; (2) green color posterior auricle in RV; and (3) the green color of the exposed part of the inner surface of the anterior shell margin close to the byssal notch. The shell is articulated as depicted. Three labels accompany ZMB 112.799:

Labels 1: "*M. margaritifera* Linn. / (young.). Hbf" [handwriting unidentified];

Label 2: "Landauer" [handwritten by Dunker];

Label 3: "coll. Dunker" [printed; glued to verso of Label 2];

Label 4: "Zoolog. Museum Berlin. [printed] / Dunker" [handwritten by Martens].

The specimen illustrated by Dunker (1872) on Plate 9, Figure 3, perfectly matches a specimen from the Dunker collection, ZMB 108.682, in shape, color, and size, and a number of unique features: (1) the number and the pattern of green radial rays; (2) a dorsally curved extremity of the anterior auricle of RV; and (3) the abrupt color change of the radial rays from green to black in the middle of RV. The specimen is shown articulated. The anterior shell margin of RV and many scales along the ventral margin of RV are damaged. The specimen was initially misidentified by Martens as the type of *A. cochenhauseni*, probably because Dunker (1872: 7) mistakenly referred to the shells illustrated on Plate 9 as Figures 1 and 2 instead of Figures 2 and 3 (see the note above and the entry for *Avicula cochenhauseni*). Later in the test, however, the figures cited properly (Dunker, 1872: 27). Two labels accompany ZMB 108.682:

Label 1: "menstr? [?] / ⁜ / *Cochenhauseni* Dkr" [handwritten by Martens];

Label 2: "Avicula / cochenhauseni Dkr ⁜ / Dunk Avic. tf 9 fig 3 / China v Cochenhausen" [handwritten by Martens].

The shell of the variety of *A*. (*M*). *margaritifera* illustrated by Dunker (1879: pl. 20, fig. 1) perfectly matches the specimen from the Dunker collection, ZMB 112.813, in shape, color, size, and several unique features: (1) the pattern and relative length of radial dark brown rays; (2) the outline of the abraded outer shell layer in the umbonal regions; and (3) the outline of extensive damage along the ventral margin, particularly at the posteroventral region. The illustration shows only a single RV, corroborating the absence of LV. Four labels accompany ZMB 112.813:

Label 1: "~~margaritifera~~ / *capensis* Sow / Dunker monogr. / 20, 1! S . 58" [handwritten by Martens];

Label 2: "*Margaritifera* / *margarit*. var. / Port Natal. / Heynemann." [handwritten by Dunker];

Label 3: "coll. Dunker" [printed; glued to verso of Label 2];

Label 4: "Zoologisches Museum Berlin. [printed] / Port Natal Dunker" [handwritten; standard ZMB label].

Avicula physoides Lamarck, 1819

Lamarck, 1819: 149, no. 12; Dunker, 1872: 25, pl. 8, figs. 2, 3 (var.).

Type locality: "Habite les mers du nord de la Nouvelle Hollande, sur des sertulaires, des plumulaires, etc." (Lamarck, 1819: 149).

Figured specimens: ZMB 112.868a, one pair of disarticulated valves, extremity of posterior auricle damaged; dimensions: hinge length 11.7 mm, height 10.8 mm, length 12.5 mm; ZMB 112.869a, one pair of disarticulated valves, anterior and ventral margins slightly damaged; dimensions: hinge length 10.8 mm, height 8.7 mm, length 9.2 mm.

Comments: To illustrate a variety of *Avicula physoides* Lamarck, 1819, Dunker used specimens from Australia communicated by Dr. Preiss (Dunker, 1872: 25). Two ZMB lots contain specimens from the Preiss collection that closely resemble the shells depicted by Dunker (1872: pl. 8, figs. 2, 3), as was previously recognized by Martens.

ZMB 112.868 contains a larger pair of disarticulated valves and a smaller single LV. The specimen with both valves resembles the figured shell by Dunker (1872: pl. 8, fig. 2) in overall shape, size, and color, although, admittedly, the illustrated shell is of darker green and somewhat generalized. Three labels accompany ZMB 112.868:

Label 1: "Avic. Papilio- / nacea, Lam. / (Mke.) Austr. / Dr. Preiß. 12" [handwritten by Dunker; original label of the Dunker collection];

Label 2: "physoïdes / Dkr / Austr / taf 8. fig 2." [handwritten by Martens];

Label 3: "coll. Dunker" [printed; glued to verso of Label 1].

ZMB 112.869 contains two pairs of disarticulated valves. One of the specimens resembles the figured shell by Dunker (1872: pl. 8, fig. 3) in overall shape, size, and non-typical for this species protruding posterior auricle. As is the case with the specimens in ZMB 112.868, the illustration is quite unspecific and does not have sufficient details to establish a definitive match with the specimens. The illustration might be an idealized composite image. Five labels accompany ZMB 112.869:

Label 1: "Avicula phy- / soïdes Lam. / (Mke. / Austr. / Dr. Preiß 8!" [handwritten by Dunker; original label of the Dunker collection];

Label 2: "Avicula papilionacea / Lam. / ad Novam Hollan / diam. / cel. Preiss." [handwriting unidentified];

Label 3: "Avicula virens / Lam. / ad Novam Hol- / landiam / cel. L. Preiss." [handwriting unidentified];

Label 4: "Dunker / Taf 8 fig ~~2~~. 3." [handwritten in ink by Martens; the number "2" crossed out in pencil by unidentified person];

Label 5: "coll. Dunker" [printed; glued to verso of Label 1].

Avicula tongana (Quoy & Gaimard, 1834)

Meleagrina tongana Quoy & Gaimard, 1833: pl. 77, figs. 14, 15; 1834: 460, 461; Dunker, 1880: 73, 74, pl. 25, fig. 5.

Type locality: "Habite Tonga-Tabou" (Quoy & Gaimard, 1834: 461).

Figured specimen: ZMB 112.870a, single LV; hinge length 21.7 mm, height 24.3 mm, length 27.3 mm.

Comments: One of two specimens in ZMB 112.870 matches the illustration by Dunker

(1880: pl. 25, fig. 5) in overall shape, color, size, and in two unique features: a little notch at posterior end of the dorsal margin and a light-colored damaged area of the posterior margin. Moreover, only LV is illustrated, which is consistent with the absence of the matching RV. This lot also contains a single RV of a much smaller specimen (approximately 10 mm hinge length) that might not be conspecific with the illustrated specimen. Three labels accompany the ZMB lot:

Label 1: "Meleagrina ton. / gana Q et G. III. / 460. t. 77. f. 14. 15! / Avic. Viridis Ch." [handwriting unidentified] "/ Dinke 25.5!" [handwritten by Martens];

Label 2: "coll. Dunker" [printed; glued to verso of Label 1];

Label 3: "Tongana / Q. G." [handwritten by Martens].

ACKNOWLEDGEMENTS

We are most grateful to the late Mrs. Ingeborg Kilias, who helped with literature research and transcribed Eduard von Martens' letters from the ZMB archives, and to Joseph Boscheinen (LMD), who provided photographs of and important information on the specimens from the Scheepmaker and Gruner collections housed at LMD. We also thank Alan Beu (Institute of Geological and Nuclear Sciences, New Zealand), Philippe Bouchet (Muséum National d'Histoire Naturelle, Paris), Rudo von Cosel (Muséum National d'Histoire Naturelle, Paris), Yuri Kantor (A. N. Severtzov Institute of Ecology and Evolution, Moscow), and Paula M. Mikkelsen (Paleontological Research Institution, Ithaca) for advise and comments on the manuscript. Lynn K. Nyhart (University of Wisconsin-Madison) brought important bibliographical sources to our attention. Eileen Westwig (American Museum of Natural History) and Karin Kiontke (New York University) provided additional assistance (to I. Tëmkin) with translations from German. Rüdiger Bieler (Field Museum of Natural History), Eugene V. Coan (Santa Barbara Museum of Natural History, California), and one anonymous referee provided invaluable suggestions for improving the manuscript. I. Tëmkin's work at the ZMB collection in October 21–29, 2004, was supported by the Annette Kade Graduate Fellowship (American Museum of Natural History). The project was supported in part by NSF-PEET DEB-9978119 (to R. Bieler and P. M. Mikkelsen) and NSF-DIG DEB-0508311 grants.

LITERATURE CITED

ADAMS, H. & A. ADAMS, 1853–1858, *The genera of Recent Mollusca; arranged according to their organization*. Volumes 1–3. J. Van Voorst, London. 1: xl + 484 pp.; 2: 661 pp.; 3: 138 pls.

ALDROVANDI, U., 1606, *De reliquis animalibus exanguibus libri quatuor, post mortem eius editi: nempe' de mollibus, crustaceis, testaceis, et zoophytis*. I. B. Bellagambam, Bononiæ [Bologna]. [6] + 593 + [28] pp.

ANDRÉE, K., 1955, Wilhelm Dunker (1809–1885) – Mineraloge, Geologe und Konchyliologe. Pp. 50–61, in: J. SCHNACK, ed., *Lebensbilder aus Kurhessen und Waldeck, 1830–1930*. Vol. 5. Elwertsche Verlagsbuchhandlung, Marburg.

ANONYMOUS, 1885, Professor Rudolf Wilhelm Dunker. *Geological Magazine* (n.s.), 2(6): 288.

BENTHEM JUTTING, W. S. S. van, 1939, A brief history of the conchological collections at the Zoological Museum of Amsterdam, with some reflections on 18th century shell cabinets and their proprietors, on the occasion on the centenary of the Royal Zoological Society "Natura Artis Magistra." Pp. 167–246, in: *Bijdragen tot de Dierkunde. Uitgegeven Door het Koninklijk Zoölogisch Genootschap "Natura Artis Magistra" te Amterdam. 27e aflevering. Feestnummer. Uitgegeven naar aandleiding van het honderdkarig bestaan van het genootschap*. E. J. Brill, Leiden.

BOSCHEINEN, J., 2004, Als das Löbbecke-Museum vor 100 Jahren eröffnet wurde... *Aquarius* [Newsletter of the Aquazoo-Löbbecke-Museum], 19: 7–9.

BOSS, K. J., 1982, Mollusca. Pp. 945–1166, in: S. P. PARKER, ed., *Synopsis and classification of living organisms*; vol. 1. McGraw-Hill, New York. xviii + 1166 pp., pls. 1–87.

BRUGUIÈRE, M., 1792 [May], *Tableau encyclopédique et méthodique des trois règnes de la nature. Contenant l'helminthologie, ou les vers infusoires, les vers intestins, les vers mollusques, &c.* (Livrasion 49, part 10). Panckoucke, Paris. 85–132 pp.

BUTLER, A. J., 1998, Order Pterioida. Pp. 261–267, in: P. L. BEESLEY, G. J. B. ROSS & A. WELLS, eds., *Mollusca: the southern synthesis. Fauna of Australia*. Volume 5, Part A. CSIRO Publishing, Melbourne. xvi + 563 pp.

CHEMNITZ, J. H., 1785, *Neues systematisches Conchylien-Cabinet*. Vol. 8. G. N. Raspe, Nürnberg. [vi] + [x] + 372 pp., pls. 70–102.

CONRAD, T. A., 1837, Descriptions of new marine shells, from Upper California. *Journal of the Academy of Natural Sciences of Philadelphia*, 7: 227–268.

COSEL, R. von, 1998, Mayor Lischke and the Japanese marine shells. A bio-bibliography of Carl Emil Lischke and a brief history of marine malacology in Japan with bibliography. *The Yuriyagai, Journal of the Malacozoological Association of Yamaguchi*, 6: 7–50.

CROSSE, H. & P. FISCHER, 1886, Nécrologie. *Journal de Conchyliologie*, 34(1): 117–118.

DANCE, S. P., 1966, *Shell collecting: an illustrated history*. University of California Press, Berkeley. 344 pp., 35 pls.

DANCE, S. P., 1980. Hugh Cuming (1791–1865) prince of collectors. *Journal of the Society for the Bibliography of Natural History*, 9: 477–501.

DANCE, S. P., 1986, A history of shell collecting. E. J. Brill, Leiden. 265 pp., 32 pls.

DELESSERT, B., 1841, Recueil de coquilles décrites par Lamarck dans son Histoire naturelle des Animaux sans Vertèbres, et non encore onate. Fortin, Masson and Cie, Paris. [94] pp.

DIJKSTRA, H. & F. KÖHLER, 2008, An annotated catalogue of Recent Pectinoidea (Mollusca: Pectinidae and Propeamussiidae) type material deposited in the Museum of Natural History, Humboldt University, Berlin. *Zoosystematics and Evolution*, 84: 29–42.

DUNKER, [W.], 1848 ["1849"], Diagnoses molluscorum novorum. *Zeitschrift für Malakozoologie*, 5(12): 177–186.

DUNKER, [W.], 1852 ["1853"], Aviculacea nova. *Zeitschrift für Malakozoologie*, 9(5): 73–80.

DUNKER, G. [W.], 1853, *Index molluscorum, quae in itinere ad Guineam inferiorem collegit Georgius Tams Med. Dr.* Th. Fischer, Cassellis Cattorum [Cassel]. vi + 74 pp.

DUNKER, [W.], 1859 ["1860"], Neue japanische Mollusken. *Malacozoologische Blätter*, 6: 221–240.

DUNKER, G. [W.], 1861, *Mollusca japonica descripta et tabulis tribus iconum illustrata*. E. Schweizerbart, Stuttgartiae [Stuttgart]. iv + 36 pp.

DUNKER, W., 1872–1880, Die Gattung *Avicula* in Abbildungen nach der Natur mit Beschreibungen. Pp. 1–84, in: H. C. KÜSTER, ed., *Systematisches Conchylien–Cabinet von Martini und Chemnitz*. Volume 7, part 3. Bauer und Raspe, Nürnberg. [Pp. 1–56, pl. 1–18, 1872; pp. 57–68, pl. 19–24, 1879; pp. 69–84, pl. 25–27, 1880; see Prashad (1932: 4) and Welter-Schultes (1999) for bibliographical details.]

DUNKER, W., 1880–1883, Die Gattung *Lithophaga* in Abbildungen nach der Natur mit Beschreibungen. Pp. 1–32, in: H. C. KÜSTER, ed., *Systematisches Conchylien-Cabinet von Martini und Chemnitz*. Volume 8, part 3a. Bauer und Raspe, Nürnberg. [Pls. 1–3, 1880; pp. 1–8, pl. 4–6, 1882; pp. 9–32, 1883; Welter-Schultes (1999).]

DUNKER, G. [W.], 1882, *Index molluscorum maris Japonici*. Th. Fischer, Cassel. [vii] + 301 pp., 16 pls.

ENGEL, H., 1939, Alphabetical list of Dutch zoological collections and menageries. Pp. 247–346, in: *Bijdragen tot de Dierkunde. Uitgegeven Door het Koninklijk Zoölogisch Genootschap "Natura Artis Magistra" te Amterdam. 27e aflevering. Feestnummer. Uitgegeven naar aandleiding van het honderdkarig bestaan van het genootschap*. E. J. Brill, Leiden.

FERNÁNDEZ MILERA, J., L. BIDART, M. d. l. A. FEIJOÓ & A. CORREOSO, 2002, Contribución de Gundlach a la malacofauna de Cuba. Pp. 171–180, in: W. DATHE & R. M. GONZÁLEZ LÓPEZ, eds., *Johann Christoph Gundlach (1810–1896): Un naturalista en Cuba / Naturforscher auf Kuba*. Basilisken-Presse, Marburg an der Lahn. 245 pp.

GIRIBET, G. & D. L. DISTEL, 2003, Bivalve phylogeny and molecular data. Pp. 45–90, in: C. LYDEARD & D. R. LINDBERG, eds., *Molecular systematics and phylogeography of mollusks*. Smithsonian Books, Washington and London. xv + 312 pp.

GLAUBRECHT, M., 2004, Leopold von Buch's legacy: treating species as dynamic natural entities, or why geography matters. *American Malacological Bulletin*, 19(1/2): 111–134.

GOULD, A. A., 1850, [Shells collected by the United States Exploring Expedition under the command of Charles Wilkes.] *Proceedings of the Boston Society of Natural History*, 3: 309–312.

GOULD, A. A., 1851, [Descriptions of new shells from California, collected by Maj. William Rich and Lieut. T. P. Green, U.S.N.] *Proceedings of the Boston Society of Natural History*, 4: 87–93.

GOULD, A. A., 1852, *United States Exploring Expedition during the years 1838–1842 under the command of Charles Wilkes, U.S.N.* 12. Mollusca & Shells. With an atlas of plates. Gould & Lincoln, Boston. xv + 510 pp.

GRAY, J. E., 1847, List of the genera of Recent Mollusca, their synonyma and types. *The Proceedings of the Zoological Society of London* for 1847[15](178): 129–219.

HWANG, J.-J. & T. OKUTANI, 2003, Taxonomy and distribution of the genera *Pteria* and *Pinctada* (Bivalvia: Pteriidae) in Taiwan. *Journal of the Fisheries Society of Taiwan*, 30(3): 199–216.

HYND, J. S., 1955, A revision of the Australian pearl-shells, genus *Pinctada* (Lamellibranchia). *Australian Journal of Marine and Freshwater Research*, 6(1): 98–137.

ICZN [International Commission on Zoological Nomenclature], 1999. *International code of zoological nomenclature = Code international de nomenclature zoologique; adopted by the International Union of Biological Sciences*. 4th ed. International Trust for Zoological Nomenclature, c/o Natural History Museum, London. xxix + 306 pp.

ICZN [International Commission on Zoological Nomenclature], 2003. Declaration 44; Amendment of Article 74.7.3. *Bulletin of Zoological Nomenclature*, 60(4): 263.

JACOBSON, M. K., 1972, Malacology in Cuba. *Sterkiana*, 45: 37–42.

JAMESON, H. L., 1901, On the identity and distribution of the mother-of-pearl oysters; with a revision of the subjenus *Margaritifera*. *Proceedings of the General Meetings for Scientific Business of the Zoological Society of London*, 1: 372–394.

JANSSEN, R., 1993, Die Typen und Typoide des Natur-Museums Senckenberg, 81. Die Typen der von Dunker 1860–1861 beschriebenen japanischen Meeresmollusken. *Archiv für Malluskenkunde*, 122: 403–435.

JONAS, I. H., 1846, Beitrag zur Erklärung der in der Description de l'Égypte abgebildeten, nebst Beschreibung einiger anderer im rothen Meer und den angrenzenden Ländern lebenden Mollusken. *Zeitschrift für Malakozoologie*, 3(4+5+10): 59–64, 65–67, 120–127.

KOBELT, W., 1885, Nekrologie. *Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft*, 17(3–4) [Beilagen Nekrologie No. 1]: 1–4.

KOBELT, W., 1904, Museum Loebbeckeanum. *Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft*, 36: 81–87.

KOENEN, A. von, 1885, Rudolf Wilhelm Dunker. *Palaeontographica*, (n.f.) 40(31): 331–338.

KÖHLER, F., 2007, Annotated type catalogue of the Bulimulinae (Pulmonata, Orthalicoidea, Bulimulidae) in the Museum für Naturkunde Berlin. *Mitteilungen aus dem Museum für Naturkunde Berlin, Zoologische Reihe*, 83: 125–159.

KÜSTER, H. C. [continued by H. C. WEINKAUFF & W. KOBELT], 1837–1920, *Systematisches Conchylien-cabinet von Martini und Chemnitz*. Bauer und Raspe, Nürnberg. [584 Lieferungen.] [Continued after the editor's death by W. Kobelt, H. C. Weinkauff & other editors of Bauer and Raspe Verlag; for bibliographical details: Welter-Schultes (1999).]

KÜSTER, H. C., W. DUNKER & S. CLESSIN, 1841–1886, Die Familie der Limnaeiden enthaltend die Genera *Planorbis*, *Limnaeus*, *Physa* und *Amphipeplea* in Abbildungen nach der Natur mit Beschreibungen. Pp. 1–34, 35a, 36a, 35–430, in: H. C. KÜSTER, ed., *Systematisches Conchylien-Cabinet von Martini und Chemnitz*. Volume 1, part 17. Bauer und Raspe, Nürnberg. [Pp. 1–8, 1841; pl. 1, 1843; pp. 9–20, pl. 2–4, 16, 1844; pp. 21–28, 35–62, pl. 5–10, 1850; pp. 29–34, 35a, 36a, 1878; pp. 63–94, pl. 11–15, 17, 1882; pp. 95–110, pl. 18–22, 1883; pp. 111–222, pl. 23–39, 1884; pp. 223–310, pl. 40–50, 1885; pp. 311–430, pl. 51–55, 1886; Welter-Schultes (1999).]

LAMARCK, [J. B. P. A. de M.] de, 1818, *L'histoire naturelle des animaux sans vertèbres*, vol. 5. Deterville & Verdière, Paris. 612 pp.

LAMARCK, [J. B. P. A. de M.] de, 1819, L'histoire naturelle des animaux sans vertèbres, Vol. 6, part 1. Chez l'auteur, au jardin du roi, Paris. [i–v], vi + 343 pp.

LEACH, W. E., 1814, *The zoological miscellany; being descriptions of new, or interesting animals*, vol. 1. Nodder & Son, London. 144 pp.

LISCHKE, C. E., 1869–1874, *Japanische Meeres-Conchylien. Ein Beitrag zur Kenntnis der Mollusken Japans mit besonderer Rücksicht auf die geographische Verbreitung derselben*. Th. Fischer, Kassel. [vol. 1: 192 pp., 14 pl., 1969; vol. 2: 184 pp., 14 pl., 1871; vol. 3: 123 pp., 9 pl., 1874.]

LINNAEUS, C., 1758, *Systema naturæ Per regna tria naturæ, Secundum classes, ordines, genera, species, Cum characteribus, differentiis, synonymis, locis*. Editio Decima, Reformata. Vol. 1. Holmiæ [Stockholm], Impensis Direct, Laurentii Salvii. 824 pp.

MARTENS, E. von, 1874, Mollusca. Pp. 103–174, in: A. NEWTON, ed., *The Zoological record for 1872; being volume ninth of the Record of Zoological Literature*. J. V. Voorst, London.

MARTENS, E. von, 1885, [*Unpublished report on the accession of Dunker's conchological collection by the Zoological Museum, Berlin, written in December*], in: Geheimes Staatsarchiv Preußischer Kulturbesitz, Berlin-Dahlem, Re. no. 176 Va, Sek2, Tit X, Nr. 63, Bd. IX, Bl. 202–215.

MEAD, A. R., 1995, Anatomical studies reveal new phylogenetic interpretations in *Lissachatina* (Pulmonata: Achatinidae). *Journal of Molluscan Studies*, 61: 257–273.

MIKKELSEN, P. M., I. TËMKIN, R. BIELER & W. G. LYONS, 2004, *Pinctada longisquamosa* (Dunker, 1852) (Bivalvia: Pteriidae), an unrecognized pearl oyster in the western Atlantic. *Malacologia*, 46(2 [Proceedings of the International Marine Bivalve Workshop 2002]): 473–501.

NEUBERT, E. & R. JANSSEN, 2004, Die Typen und Typoide des Natur-Museums Senckenberg, 84: Mollusca: Gastropoda: Pulmonata: Orthalicoidea: Bulimulidae (2), Orthalicidae, Placostylidae. *Archiv für Molluskenkunde*, 133(1/2): 193–297.

NEWELL, N. D., 1969, Superfamily Pteriacea Gray, 1847 (1820). P. N297, in: L. R. COX et al., eds., *Treatise on Invertebrate Paleontology, Part N. Mollusca 6: Bivalvia*, Volume 1. Geological Society of America and University of Kansas, Lawrence, Kansas. xxxviii + 489 pp.

PALMER, T. J., 1984, Revision of the bivalve family Pulvinitidae Stephenson, 1941. *Palaeontology*, 27(4): 815–824.

PAPAVERO, N., 1971, *Essays on the history of neotropical dipterology, with special reference to the collectors (1750–1905)*, vol. 1. Museu de Zoologia, Universidade de São Paulo, São Paulo. vii + 216 pp.

PEASE, W. H., 1862, Descriptions of new species of shells from the Pacific Islands. *Proceedings of the Scientific Meetings of the Zoological Society of London*: 243–245.

PIECHOCKI, R., 1992, Johannes Gundlach (1810–1896): Ein deutscher Naturforscher auf Kuba und das Zoologische Museum in Berlin. *Der Falke*, 4: 133–140.

PRASHAD, B., 1932, *The Lamellibranchia of the Siboga expedition*. Systematic part. 2. Pelecypoda (exclusive of the Pectinidae). E. J. Brill, Leiden. 353 pp., 9 pls., 1 map.

[QUOY, J. R. C. & P. GAIMARD], 1833, *Voyage de la corvette l'Astrolabe exécuté par ordre du roi, pendant les années 1826–1827–1828–1829, sous le commandement de m. J. Dumont d'Urville, capitaine de vaisseau*. Atlas. J. Tastu, Paris. 107 pls.

QUOY, [J. R. C.] & [P.] GAIMARD, 1834, *Voyage de découvertes de L'Astrolabe exécuté par ordre du Roi, pendant les années 1826–1827–1828–1829, sous le commandement de M. J. Dumont D'Urville. Zoologie*, vol. 3. J. Tastu, Paris. 954 pp.

RAMSDEN, C. T., 1915, Juan Gundlach. *Entomological News and Proceedings of the Entomological Section of the Academy of Natural Sciences of Philadelphia*, 26: 241–260.

RANSON, G., 1961, *Les espèces d'huîtres perlières du genre Pinctada* (*Biologie de quelques-unes d'entre elles*). Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Mémoires, 12ème Série, Fasc. 67: 1–95 pp., 42 pls.

REEVE, L. A., 1857, Monograph of the genus *Avicula*, in: L. A. REEVE, *Conchologia Iconica, or illustrations of the shells of molluscous animals*, vol, 10. L. Reeve, London. [20 pp.], 18 pls.

REEVE, L. A. [continued by G. B. SOWERBY II], 1843–1878, *Conchologia Iconica or, illustrations of the shells of molluscous animals*. L. Reeve, London. [20 volumes.]

REGENFUSS, F. M., 1758, *Auserlesene Schnekken, Muscheln und andre Schaalthiere, af allerhöchsten Befehl Seiner Königlichen Majestät: nach den Originalen gemalt, in Kupfer gestochen, und mit natürlichen Farben erleuchtet*. Kopenhagen. [18] + xiv + 22 + lxxxvii pp.

[RÖDING, P. F.], 1798, *Museum Boltenianum sive catalogus cimeliorum e tribus regnis naturæ quæ olim collegerat Fon. Fried Bolten, M.D.p.d. per XL annus Proto physicus Hmburgensis*. Pars Secunda continens Conchylia sive Testacea univalvia, bivalvia & multivalvia. Hamburgi [Hamburg]. viii + 199 pp.

RONDELETIUS [RONDELET], G., 1554–1555, *Libri de piscibus marinis in quibus veræ piscium effigies expressae sunt quæ in tota piscium historia continentur, indicat elenchus pagina nona et decima onatea accesserunt indices necessarij*. M. Bonhomme, Lugduni [Lyon]. [16] + 583 + [24] + [12] + 242 + [10] pp.

SCHMIDT, W., 1973, Marburg und die Paläontologie. *Geologica et Paleontologica*, 7: 1–25.

SCHNEPPEN, H., 2006, *Sansibar und die Deutschen. Ein besonderes Verhältnis 1844–1966*. LIT-Verlag, Münster. 562 pp.

SCOPOLI, G. A. I. A., 1777, *Introductio ad historiam naturalem sistens genera lapidum, plantarum et animalium: hactenus detecta, caracteribus essentialibus onate, in tribus divisa, subinde ad leges naturae*. W. Gerle, Pragae [Prague]. [x] + 506 + [34] pp.

SHIRAI, S., 1994, *Pearls and pearl oysters of the world*. Kousoku Printing Co., Okinawa, Japan. 108 pp.

STEINER, G. & S. HAMMER, 2000, Molecular phylogeny of the Bivalvia inferred from 18S rDNA sequences with particular reference to the Pteriomorphia. Pp. 11–29, in: E. M. HARPER, J. D. TAYLOR & J. A. CRAME, eds., *The evolutionary biology of the Bivalvia* [Proceedings of "Biology & Evolution of the Bivalvia," an international symposium organized by the Malacological Society of London, 14–17 September 1999, Cambridge, UK]. Geological Society, London, Special Publications, 177: vii + 494 pp.

STEPHENSON, L. W., 1941, The larger invertebrate fossils of the Navarro Group of Texas (exclusive of corals and crustaceans and exclusive of the fauna of the Escondido Formation). *The University of Texas Publication*, 4101: 1–641.

STOLICZKA, F., 1870–1871, Cretaceous fauna of Southern India, 3: The Pelecypoda, with a review of all known genera of this class, fossil and recent. *Memoirs of the Geological Survey of India. Palæontologia Indica*, Series 6. xxii + 538 pp., 50 + 4 pls. [1–222, pls. 1–12 + 4, 1 Sept. 1870; 223–408, pls. 13–28, 1 March 1871; xxii + 409–538, pls. 29–50, 1 Aug. 1871]

TAMS, G., 1845, *Die portugiesischen Besitzungen in Süd-West Afrika*. R. Kittler, Hamburg. [English translation: Tams, G., 1845, *Visit to the Portuguese possessions in south-western Africa*. Translated from the German by H. Evans Lloyd. T. C. Newby, London. 2 volumes.]

TËMKIN, I., 2006a, Morphological perspective on classification and evolution of Recent Pterioidea (Mollusca: Bivalvia). *Zoological Journal of the Linnean Society*, 148(3): 253–312.

TËMKIN, I., 2006b, Anatomy, shell morphology, and microstructure of the living fossil *Pulvinites exempla* (Hedley, 1914) (Bivalvia: Pulvinitidae). *Zoological Journal of the Linnean Society*, 148(3): 523–552.

TOMLIN, J. R. le B., 1942, Shell sales. III. *Proceedings of the Malacological Society of London*, 25(3): 97–99.

TREW, A., 1990, John R. le B. Tomlin's new molluscan names. National Museum of Wales, Cardiff. 101 pp.

WANG, Z., 1978, A study of the Chinese of the family Pteriidae (Mollusca). *Studia Marina Sinica*, 14: 101–115.

WEIDNER, H., 1993, Bilder aus der Geschichte des Zoologischen Museums der Universität Hamburg. Die Zoologischen Sammlungen im Naturhistorischen Museum zu Hamburg während seiner Kollegialverfassung 1843 bis 1882. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut*, 90 (Suppl.): 1–380.

WELTER-SCHULTES, F. W., 1999, *Systematisches Conchylien-Cabinet von Martini und Chemnitz* (1837–1920), bibliography of the volumes in Göttingen. *Archives of Natural History*, 26(2): 157–203.

WOODRING, W. P., 1925, Miocene Mollusca from Bowden Jamaica, pelecypods and scaphopods. *Carnegie Institution of Washington, Publication*, 366: 1–564.

ZILCH, A., 1967, Aus der Geschichte des Senckenberg-Museums. Nr. 13. Geschichte der malakologischen Sektion. *Archiv für Malluskenkunde*, 97: 7–43.

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